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Tulare Lake Hydrologic Region

Tulare Lake Hydrologic Region Summary and Recommendations

Summary

[This subsection contains a discussion of the following topics.]

- Highlights from regional report leading up to resource management strategies and policies.]

Resource Management Strategies and Policies

[This subsection contains a discussion of the following topics. (Primary authors may be Regional Office staff, coordinating with design teams and regional forum participants with an emphasis on local integrated regional water management [IRWM] managers.)

- Implementation recommendations (and priorities where possible).]

[Sources for this information may be IRWM plans, the Senate Bill x7-7 process, urban water management plans, agricultural water management plans, groundwater management plans, water elements of general plans, floodplain management plans, stormwater plans, Regional Water Quality Control Board basin plans and water quality reports, watershed management plans, habitat conservation plans, multi-species conservation plans, etc.]

[Considerations for this subsection:

- This section will directly support funding recommendations in the Update 2013 finance plan (within Volume 1).
- Priorities will be regionally driven and can vary from specific regionally preferred projects to entire IRWM or other plans.
- Priorities can be expressed by IRWM, county, or another geopolitical subdivision.]

The Water Boards are responsible for the coordination and control of water quality in California. The Central Valley Water Board is responsible for the Tulare Lake Basin. The following are programmatic level recommendations to improve water quality in the Tulare Lake Hydrologic Region: CV-SALTS: Throughout the Central Valley, and particularly in the Tulare Lake Basin which is a closed basin, participating in the development of salt and nitrate management plans is very important to improving water quality in the region and providing for a sustainable economic and environmental future. The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is a strategic initiative to address problems with salinity and nitrates in the surface waters and ground waters of the Central Valley. The long-term plan developed under CV-SALTS will identify and require discharger implementation of management measures aimed at the reduction and/or control of major sources of salt and nitrate as well as support activities that alleviate known impairments to drinking water supplies. As this issue impacts all users (stakeholders) of water within the Tulare Lake Hydrologic Region, it is important that all stakeholders participate in CV-SALTS to be part of the development and have input on the implementation of salt and nitrate management within the Tulare Lake area. For the Central Valley, the only acceptable process to develop the salt and nutrient management plans that are required under state policy (SWRCB. 2009) is through CV-SALTS. Groundwater Quality Protection Strategy: To protect

groundwater quality, the Central Valley Water Board approved a strategy which recommends the following actions:

- Develop Salt & Nutrient Management Plan
- Implement Groundwater Quality Monitoring Program
- Implement Groundwater Protection Programs through IRWM Plan Groups
- Broaden Public Participation in all programs
- Coordinate with local agencies to implement Well Design & Destruction Program
- Groundwater Database
- Alternative Dairy Waste Disposal
- Develop individual and general orders for Poultry, Cattle Feedlots and other types CAFOs
- Implementation of Long-term ILRP
- Coordinate with CDFA to identify methods to enhance fertilizer program
- Reduce Site Cleanup Backlog
- Draft waiver following new regulation adopted based on AB885
- Update Guidelines for Waste Disposal for Land Developments.
- Develop methods to reduce backlog and increase facilities regulated

[Placeholder groundwater text. Contains:

- Summary of groundwater-related resource management strategies and policies in the Hydrologic Region.
- Summary of groundwater data gaps for the Hydrologic Region, how these gaps affect groundwater management and policy, and recommendations to reduce data gaps in the future.
- Selected maps and tables from the main text of the report, as appropriate.
- Discussion on groundwater sustainability and sustainability indicators to monitor progress towards the resource sustainability.]

DWR has solicited and awarded several rounds of IRWM Planning and Implementation grants with Proposition 84 funding (Table TL-1).

PLACEHOLDER Table TL-1 Integrated Regional Water Management Grants Awarded

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Water Planning and Governance

[This subsection contains a discussion of the following topics.

- Institutional improvements, expansion of IRWM partnerships (e.g., tribal) and alternatives to IRWM where appropriate.]

[Considerations for this subsection:

- This section will take a critical look at IRWM as it pertains to each region.]

[Placeholder groundwater text. Contains:

- Summary of groundwater governance associated with the various groundwater management plans (GWMPs), Integrated Regional Water Management (IRWM) Plans, conjunctive

management projects and groundwater recharge projects, groundwater monitoring, groundwater ordinances, and adjudicated groundwater basins within the Hydrologic Region.

- Summary table of groundwater-related planning and governance within the Hydrologic Region.
- Summary discussion on Case Studies – successes and challenges.]

Current State of the Region

In the Tulare Lake Hydrologic Region, more than half a million residents, \$32 billion in assets (crops, buildings, and public infrastructure), and over 190 sensitive species are exposed to a 500-year flood event. More specifically, in Tulare County, half of the residents and 34 percent of the agricultural crops, totaling \$2.3 billion, are exposed to the 500-year flood event. To address the higher risk of flooding in this hydrologic region, more than 4,000 miles of levees, and 55 dams, reservoirs and weirs have been constructed. This hydrologic region also has two reservoirs—Lake Isabel and Lake Success—that are in need of a seismic retrofit. The hydrologic region faces a number of issues related to infrastructure, including decertification of levees, inadequate and aging infrastructure, seismic retrofit needs, and new infrastructure needs.

The Tulare Lake Hydrologic Region is divided into several main hydrologic subareas—the alluvial fans for the Sierra foothills and basin subarea, bed of Tulare Lake, and the southwestern uplands. The dominant hydrologic features in the alluvial fan/basin subareas are Tulare Lake and the Kings, Kaweah, Tule, and Kern rivers and their major tributaries. All of the streams in Tulare Lake hydrologic region are diverted for irrigation or other purposes. The valley floor is flat, and the entire volume of most of the larger streams flows into multiple channels and irrigation canals, reaching Tulare Lake only in years of extremely high runoff. This pattern is known as an Atmospheric River. For a complete record of floods, refer California Flood Future Report Attachment C: Flood History of California Technical Memorandum.

Setting

[This subsection contains a discussion of the following topics. (Regional Office staff to be primary authors.)

- An overview of background factors that affect water availability, uses, quality, flood management, and ecosystems in the region and unique sub-regions.
- IRWM plans, basin plans, land use surveys, Department of Finance population data, conservancy reports, regional studies, climate programs, etc.]

[Considerations for this subsection:

- Develop brief descriptions of tribal communities in the hydrologic region or overlay region.
- Update background information about watershed topography, geology, rivers, and ecosystems.
- Update climate overview and identify trends.
- Update population and land use information and trends.
- Provide links to detailed information in the reference guide (Volume 4 of Update 2013).]

The Tulare Lake Hydrologic Region covers approximately 10.9 million acres (17,050 square miles) and includes all of Kings and Tulare counties and most of Fresno and Kern counties (Figure TL-1). The southern portion of the San Joaquin Valley is subdivided into two separate basins, the San Joaquin and the Tulare, by a rise in the valley floor resulting from an accumulation of alluvium between the San

Joaquin River and the Kings River fan. The valley floor in this region had been a complex series of interconnecting natural sloughs, canals, and marshes.

PLACEHOLDER Figure TL-1 Tulare Lake Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

The economic development of the region is closely linked to the surface water and groundwater resources of the Tulare Lake Hydrologic Region (Tulare Lake region). Major rivers draining into the Tulare Lake region include the Kings, Kaweah, Tule, and Kern rivers. The original ecological character of the area has been changed dramatically, largely from the taming of local rivers for farming. Significant geographic features include the Buena Vista/Kern Lake and Tulare Lake beds, comprising the southern half of the region; the Coast Range to the west; the Tehachapi Mountains to the south; and the southern Sierra Nevada to the east.

The Tulare Lake Hydrologic Region is one of the nation's leading agricultural production areas, growing a wide variety of crops on about 3 million irrigated acres. Agricultural production has been a mainstay of the region since the late 1800s. However, since the mid-1980s, other economic sectors, particularly the service sector, have been growing.

Watersheds

The Tulare Lake region is divided into several main hydrologic subareas: the alluvial fans from the Sierra foothills and the basin subarea (in the vicinity of the Kings, Kaweah, and Tule rivers and their distributaries); the Tulare Lake bed; and the southwestern uplands. The alluvial fan/basin subarea is characterized by southwest to south flowing rivers, creeks, and irrigation canal systems that convey surface water originating from the Sierra Nevada. The dominant hydrologic features in the alluvial fan/basin subarea are the Kings, Kaweah, Tule, and Kern rivers and their major distributaries. Four main rivers emanate from the western flanks of the southern Sierra Nevada, and one substantial creek enters from the Coast Range. The largest river in terms of runoff is the Kings River, which originates high in Kings Canyon National Park and generally trends southwest into Pine Flat Lake. Downstream of Pine Flat Dam the river flows south and west toward Tulare Lake. During flood release events from Pine Flat Reservoir, the majority of the Kings River flow is diverted northwest into the Fresno Slough/James Bypass system (along the historically high-water outlet of Tulare Lake), emptying into the San Joaquin River. The Kaweah River begins in Sequoia National Park, flows west and southwest, and is impounded by Terminus Dam. It subsequently spreads into many distributaries around Visalia and Tulare trending toward Tulare Lake. The Tule River begins in Sequoia National Forest and flows southwest through Lake Success toward Tulare Lake.

The Kern River has the largest drainage basin area and produces the second highest runoff. It originates in Inyo and Sequoia national forests and Sequoia National Park, flowing southward into Lake Isabella. The river downstream of Isabella Dam flows southwest; and in high discharge years, water will spill into the ancient Buena Vista/Kern Lake bed. In very high discharge years, Buena Vista Lake historically spilled into Tulare Lake via sloughs and floodwater channels. In addition, some Kern River water may be allowed to flow into the SWP via the Kern River Intertie. Los Gatos Creek, arising in the Coast Range, flows southeast onto the valley floor north of Tulare Lake. In extreme floods it may join the Kings River,

flowing south toward the lake. There are many smaller creeks that feed into the main rivers, which can present a localized flooding threat during specific storm conditions.

Groundwater Aquifers

[Placeholder groundwater text. Contains:

- Brief physical description of the significant alluvial and fractured rock (if applicable) aquifer systems within the Hydrologic Region.
- Brief description of the priority groundwater basins within the Hydrologic Region.
- Table showing the groundwater basins and subbasins within the Hydrologic Region, by their priority designations.
- Map showing the groundwater basins and subbasins within the Hydrologic Region, by their priority designations.
- Brief discussion of the well infrastructure, with an explanation of the data gaps associated with this important dataset.
- Brief and general discussion of groundwater occurrence and movement, and identification of key recharge and discharge areas, subject to availability of information.
- Map showing groundwater elevation contours with arrows depicting general direction of groundwater movement, subject to availability of information.]

Ecosystems

The Tulare Lake region once supported vast tule marshes, riparian corridors, and other wetlands; however, development of the area largely for farming, and the taming of the region's major rivers, has dramatically changed the ecological character. The valley portion of the region once supported a diverse array of perennial bunchgrass ecosystems including prairies, oak-grass savannas, desert grasslands, as well as a mosaic of riparian woodlands, freshwater marshes, and vernal pools. In its original state, it comprised one of the most diverse, productive, and distinctive grasslands in temperate North America and more than 500,000 acres of permanent and seasonal wetlands (www.worldwildlife.org, California Central Valley grasslands [NA0801]).

Most basins in California have lost the majority of their wetlands habitat; but in the Tulare Lake region, changes have been especially detrimental for waterfowl. The region once contained a series of shallow lakebeds that provided 260,000 acres of seasonal wetlands and more than 250,000 acres of permanent and semi-permanent tule marshes.

[More than 95 percent of historical wetlands and 98 percent of all riparian habitats have been destroyed or modified. The remnant of intensively managed wetlands and associated agricultural habitats now support an average of 5.5 million waterfowl annually.]

PLACEHOLDER Table TL-2 Selected Regionally Endemic Endangered Plant Species

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

PLACEHOLDER Table TL-3 Selected California Endemic Endangered Plant Species

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

PLACEHOLDER Table TL-4 Endangered Wildlife Species

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Climate

The climate in combination with the fertile soil in the valley portion of the region is well suited for farming. Runoff from the adjacent Sierra Nevada provides good quality water for irrigation along with local groundwater. The San Joaquin Valley's long growing season (April through October), warm/hot summers, and a fall harvest period usually sparse in rain provides a near ideal environment for production of many crops. Winters are moist and often blanketed with tule fog. Nearly all of the year's precipitation falls in the six months from November to April. The valley floor is surrounded on three sides by mountain ranges, resulting in a comparative isolation of the valley from marine effects. Because of this and the comparatively cloudless summers, normal maximum temperature advances to a high of 101 degrees Fahrenheit during the latter part of July. Valley winter temperatures are usually mild, but during infrequent cold spells air temperature occasionally drops below freezing. Heavy frost occurs during the winter in most years, and the geographic orientation of the valley generates prevailing winds from the northwest.

The mean annual precipitation in the valley portion of the region ranges from about 6 to 11 inches, with 67 percent falling from December through March, and 95 percent falling from October through April. The region receives more than 70 percent of the possible amount of sunshine during all but four months, November through February. Tule fog, which can last up to two weeks, reduces sunshine to a minimum.

Demographics

PLACEHOLDER Figure TL-2 Tulare Lake Hydrologic Region Disadvantaged Communities and Integrated Regional Water Management

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

PLACEHOLDER Table TL-5 Disadvantaged Communities by County with Populations of 2,000 or More

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

PLACEHOLDER Table TL-6 Tulare Lake Hydrologic Region Population by County

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Tulare Lake Hydrologic Region had almost 2.27 million people according to the 2010 Census. Between 2005 and 2010, the region's population grew by 174,029 people or about 8.3 %. Among the larger counties in the Tulare Lake HR, Kern County grew the fastest both from 2000-2005 and 2005-2010 with population increases of 15.7% and 10.7%, respectively. About **x percent** of the state's total population lives in this region, and 71 percent of the region's population lives in incorporated cities.

**PLACEHOLDER Table TL-7 Tulare Lake Hydrologic Region
2010 Top Ten Populous Incorporated Cities**

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Land Use Patterns

PLACEHOLDER Table TL-8 Tulare Lake Hydrologic Region 20 Crop Type Acreages 2005-2009

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Levee and Channel System

The Tulare Lake Hydrologic Region has flood management facilities for the protection of cities and agricultural areas, particularly for the valuable lake bed farm lands. Installations include the Kings River Flood Control Project, four multi-purpose reservoirs with flood management reservations, four major single-purpose flood management reservoirs, five smaller flood management reservoirs, a sedimentation basin, diversions, weirs, levees, and channel improvements.

The Kings River Flood Control Project uses weirs, levees, and channel improvements to contain the flows of the Kings River, Crescent Bypass, North Fork Kings River, Fresno Slough, South Fork Kings River, Clarks Fork Kings River, Cole Slough, and Dutch John Cut and direct the flows toward irrigation facilities, Tulare Lake, or the San Joaquin River as needed.

Tribal Communities

PLACEHOLDER Table TL-9 Federally Recognized Tribes in Tulare Lake Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

**PLACEHOLDER Table TL-10 Integrated Regional Water Management
Tribal Participation in Tulare Lake Hydrologic Region**

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Federal Clean Water Act (CWA) Programs and Tribes

Under the Clean Water Act, the US Environmental Protection Agency (US EPA) administers programs that support federally recognized tribes to address nonpoint source (NPS) pollution, water pollution control programs, and watershed based planning efforts. In the United States, there are approximately 565 federally recognized tribes. In California, there are 110 federally recognized tribes, 20% of the total nationally.

According to the Bureau of Indian Affairs, "federally recognized" means that most of today's federally recognized tribes received federal recognition status through treaties, acts of Congress, presidential executive orders or other federal administrative actions, or federal court decisions. In addition, in 1994, Congress enacted Public Law 103-454, the Federally Recognized Indian Tribe List Act (108 Stat. 4791, 4792), which formally established three ways in which an Indian group may become federally

recognized: 1) by Act of Congress; 2) by the administrative procedures under 25 C.F.R. Part 83; *or* 3) by decision of a United States court. However, a tribe whose relationship with the United States has been expressly terminated by Congress may not use the Federal Acknowledgment Process. Only Congress can restore federal recognition to a “terminated” tribe.

Because of unique and extremely complex historical circumstances, there are a large number of non-recognized tribes in California, including terminated tribes that may be seeking restoration or recognition by the United States. Tribal existence and identity do not depend on federal recognition or acknowledgement of a tribe. However, in order to be eligible for CWA programs, a tribe must be federally recognized, along with additional requirements. One of the requirements is receiving treatment as a state (TAS) authorization pursuant to §518(e) of the CWA.

For the federal fiscal year 2012 there were 170 tribes nationally that had TAS authorization. In California, 60 federally recognized tribes have TAS status which is over one third (35%) of the national total, and 55% of the total of federally-recognized tribes in California.

Section 319 of the CWA authorizes federal grants to states and tribes in order to implement approved programs and on-the-ground projects to reduce nonpoint source pollutions problems. In the San Juan River Hydrologic Region, there are three tribes with TAS status and are eligible for Section 319 program funding: Cold Springs Rancheria of Mono Indians; Santa Rosa Rancheria; and Tule River Indian Tribe.

Section 319 funding also supports the development of watershed-based plans. In California, [placeholder here, awaiting additional information to be inserted].

Section 106 of the CWA authorizes federal grants to assist state and interstate agencies in administering water pollution control programs. Tribes with TAS status can receive Section 106 funding. This program allows tribes to address water quality issues by developing monitoring programs, water quality assessment, standards development, planning, and other activities intended to manage reservation water resources. In California, 68 tribes and one inter-tribal consortium are involved in Section 106 programs. In the San Juan River Hydrologic Region, there are six tribes involved in Section 106 programs and activities: Cold Springs Rancheria of Mono Indians; Santa Rosa Rancheria; and Tule River Indian Tribe.

Regional Resource Management Conditions

[This subsection contains a discussion of the following topics. (Primary authors are regional entities who wish to partner with Regional Office staff, the water supply and balances work team, the integrated flood management work team, and the ecosystem planning work team.)

- A characterization of environmental water use and demands.
- Water portfolios (1998-2009).
- Change in groundwater storage.
- An updated write-up from the Update 2009 regional report flood appendix.]

[Sources of this information may be IRWM plans, statewide flood management planning report, groundwater enhancements, local agency, and portfolio data; Bulletin 118, State Water Resources Control Board, and Department of Public Health data; U.S. Army Corps of Engineers, Division of Flood Management, Federal Emergency Management Agency, Federal Energy Regulatory Commission

(FERC), National Marine Fisheries Service, and operations criteria and plan (OCAP) reports; and FERC licenses.]

[Considerations for this subsection:

- Quantify water supplies, uses, quality, imports, and exports.
- Estimate uses by source, uses by sector, and other subcategories based on documented assumptions.
- If possible, indicate the level of uncertainty for reported data.
- Identify wild and scenic rivers, instream flow and Delta outflow requirements, etc.
- Describe water supply sources (groundwater, surface, recycling, desalination, regional imports, etc.) and water rights.
- Summarize agricultural, urban, and managed wetland water use.
- Compare water use and supply parameters to show effects on water availability for beneficial uses (change over time, relative fractions of total, use rates for each region, and correlated factors).
- Summarize water quality conditions.
- Describe flood management systems, risks, procedures, and responsibilities.
- Summarize key operational criteria for large regional water projects.
- Governance summary: Identify responsibility of local governments, tribal government, agencies, and institutions for managing water resources, flood protection, and wastewater.
- Provide links to detailed information in the reference guide.
- Describe tribal participation in regional resource management.]

Water in the Environment

PLACEHOLDER Table TL-11 Surface Water Deliveries to Kern National Wildlife Refuge (Thousand Acre-Feet)

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

PLACEHOLDER Table TL-12 Surface Water Deliveries to Mendota Wildlife Area (Thousand Acre-Feet)

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

PLACEHOLDER Table TL-13 Dedicated Natural Flows

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

[Placeholder groundwater text. Contains:

- Description of the groundwater related environmental issues for the Hydrologic Region based on connection, disconnection, or seasonal connection between the aquifer groundwater table and the local surface water systems (including wetlands), subject to availability of data.
- Description of the importance of protecting groundwater recharge areas, and potential environmental consequences associated with contaminated aquifers.]

Water Governance

PLACEHOLDER Table TL-14 Selected Organizations in Tulare Lake Hydrologic Region Involved in Water Governance

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

[Placeholder groundwater text. Contains:

- Discussions of the various governance approaches to groundwater management within the Hydrologic Region and identification of specific GWMPs, IRWM Plans, groundwater ordinances, and adjudicated groundwater basins within the Hydrologic Region.
- Table listing the GWMPs, IRWMs, groundwater ordinances, and adjudicated groundwater basins.
- Maps showing area coverage for GWMPs and IRWMs, and “dot” locations of groundwater ordinances and adjudicated basins.]

California’s water resource development has resulted in a complex, fragmented, and intertwined physical and governmental infrastructure. Although primary responsibility might be assigned to a specific local entity, aggregate responsibilities are spread among more than 165 agencies in the Tulare Lake Hydrologic Region with many different governance structures. A list of agencies can be found in the California’s Flood Future Report Attachment E: Information Gathering Technical Memorandum. Agency roles and responsibilities can be limited by how the agency was formed, which might include enabling legislation, a charter, a memorandum of understanding with other agencies, or facility ownership

The Tulare Lake Hydrologic Region contains floodwater storage facilities and channel improvements funded and/or built by the State and Federal agencies. Flood management agencies are responsible for operating and maintaining approximately 4,100 miles of levees and more than 50 dams and reservoirs, and other facilities within the Tulare Lake hydrologic region. For a list of major infrastructure, refer California’s Flood Future Report Attachment E: Information Gathering Technical Memorandum.

Water Supplies

Agricultural Water

PLACEHOLDER Figure TL-3 Total Agricultural Applied Water by Supply Source (Thousand Acre-Feet) (with Supply Source as a Percentage of Total Agricultural Applied Water)

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

During a normal water year like 2005, surface water supplies approximately 70% of the agricultural water demand in the TL HR. However, during critically dry periods such as 2009, farmers rely on groundwater supplies with almost 69% of the applied water demand being met by groundwater (see Figure TL-3).

Recycled Municipal Water

According to the 2009 Municipal Wastewater Recycling Survey, compiled by the State Water Resources Control Board, 126,320 acre feet per year are being recycled in the Tulare Lake Region. Most of the recycled water was used for agricultural irrigation with a relatively small quantity used for groundwater

recharge and landscape irrigation. (SWRCB. 2011a) State policy (SWRCB. 2009) encourages increased use of recycled water but recognizes the potential of recycled water to contribute to exceeding or threatening to exceed water quality objectives due to salt and nutrients. Therefore, the policy requires stakeholders to work together to develop salt and nutrient management plans.

In the Central Valley, of which the Tulare Lake Region is a part of, the Central Valley Water Board and the State Water Board, as part of a stakeholder effort, are developing a comprehensive salt and nitrate management plans for the Central Valley. The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is a strategic initiative to address problems with salinity and nitrates in the surface waters and ground waters of the Central Valley. The long-term plan developed under CV-SALTS will identify and require discharger implementation of management measures aimed at the reduction and/or control of major sources of salt and nitrate as well as support activities that alleviate known impairments to drinking water supplies. As this issue impacts all users (stakeholders) of water within the Tulare Lake Region, it is important that all stakeholders participate in CV-SALTS to be part of the development and have input on the implementation of salt and nitrate management within the Tulare Lake Region. For the Central Valley, the only acceptable process to develop the salt and nutrient management plans that are required under state policy (SWRCB. 2009) is through CV-SALTS.

Drinking Water:

[Placeholder: Drinking water content to come.]

[Placeholder groundwater text. Contains:

- Description of the major agricultural and municipal areas served and trends in the water use met by groundwater supply, such as more or less reliance on groundwater supply over time.
- Map illustrating the location of major water use met by groundwater supply.
- Table illustrating the trends in water use met by groundwater supply.
- Description of seasonal and long-term groundwater level trends, an overview of groundwater supply sustainability based on existing management considerations, and groundwater change in storage, subject to availability of information.
- Charts of selected well hydrographs illustrating the variability, challenges, and successes in groundwater management in the Hydrologic Region.]

Water Uses

[The quantities of water uses would be provided in the water portfolios; however, a narrative to bring forward the story this data provides would be included here.]

Agriculture applies ~93% while wildlife refuges apply ~1% and urban applies ~6%, respectively of the total applied water in the Tulare Lake HR (see Table TL-15 for the yearly distribution).

PLACEHOLDER Table TL-15 Tulare Lake Hydrologic Region Water Demands

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Drinking Water

The region has an estimated 355 community drinking water systems. The majority (over 80%) of these community drinking water systems are considered small (serving less than 3,300 people) with most small

water systems serving less than 500 people (see Table TL-16). Small water systems face unique financial and operational challenges in providing safe drinking water. Given their small customer base, many small water systems cannot develop or access the technical, managerial, and financial resources needed to comply with new and existing regulations. These water systems may be geographically isolated, and their staff often lack the time or expertise to make needed infrastructure repairs; install or operate treatment; or develop comprehensive source water protection plans, financial plans or asset management plans (USEPA 2012).

In contrast, medium and large water systems account for less than 20% of region's drinking water systems; however these systems deliver drinking water to over 90% of the region's population (see Table TL-16 below for CWS details). These water systems generally have financial resources to hire staff to oversee daily operations and maintenance needs, and hire staff to plan for future infrastructure replacement and capital improvements. This helps to ensure that existing and future drinking water standards can be met.

PLACEHOLDER Table TL-16 Community Water Systems by Size and Population Served

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

[Placeholder groundwater text. Contains:

- Description of the annual groundwater use/demand by beneficial use (agricultural, municipal, and managed wetlands), and by aquifer type (alluvial versus fractured rock, if applicable),
- Discussion of groundwater use as it relates to basin priority.
- Map showing groundwater use as a percentage of the overall supply for alluvial and fractured rock aquifer (if applicable) areas, with overlay of basin prioritization.]

Project Operations

[Major water supply project operations could be described here, along with challenges faced in the operations. Include a description of how reservoirs and facilities are operated to meet the varied and changing demands.]

Water Quality

Due to the closed nature of the Tulare Lake Basin, the impact of contaminants on water quality will be a continuing threat to beneficial uses of surface water and groundwater. The paramount water quality problem in the Basin is the accumulation of salts including nitrate. This problem is compounded by the overdraft of ground water for municipal, agricultural, and industrial purposes, and the use of water from deeper formations and outside the basin, which further concentrates salts within remaining ground water. (CVRWQCB. 2004)

High salt concentrations can affect crop growth, cause health and taste problems in drinking water, and damage water delivery, conveyance, and treatment systems. Thousands of acres in the Tulare Lake Basin can no longer be farmed due to high salinity in the soils. In some parts of the Central Valley, drinking water does not meet state and federal standards for human consumption due to nitrate concentrations. The environment is also vulnerable to salt impacts – increasing salts in rivers and streams can alter the plants and fish that can survive there. (CV-SALTS. 2012a)

Development and adoption of a comprehensive Salt and Nitrate Management Plan for the Central Valley, including an implementation plan, is a high priority for this region.

Surface Water Quality

Generally, flows from the east side of the Basin are considered to be excellent quality fed by Sierra snowmelt and springs from granitic bedrock. Flows from the west side are considered to be poor quality due to naturally occurring constituents such as selenium and salinity from the marine sediments. Water quality issues for the Tulare Lake Hydrologic Region include:

- Salinity
- Pesticides (chlorpyrifos, dimethoate, and toxaphene) from agriculture
- Metals (mercury, selenium, and molybdenum)
- Erosion and sediment (SWRCB. 2010)

Salinity is the primary contaminant affecting water quality and habitat in the Tulare Lake region. When water is used, salts are left behind. Sometimes this salt is intentionally added (e.g., home water softeners, plant fertilizers), but even when no salts are added to the system, evaporation and consumptive use act to concentrate unused salts. Additionally, salts move with water so salts originating in one basin will turn up in another. This is a significant problem when the receiving basin has no reliable way of disposing the salt, as is the case in the Tulare Lake Hydrologic Region. Salinity increases can affect municipal, agricultural, and industrial beneficial uses of water and the ability to recycle and reuse municipal wastewater.

In the Tulare Lake region, pesticide impairments due to chlorpyrifos, dimethoate and toxaphene have been identified in areas of agricultural production (SWRCB. 2010). Pesticides are man-made chemicals used to control insects. A fraction of the applied pesticides can enter surface waters during rainfall or irrigation events when residual pesticides migrate in stormwater runoff or irrigation return water or migrate with sediment carried in stormwater runoff or irrigation return water and cause unintended toxicity to aquatic life. Toxaphene is considered a legacy pesticide since its use has been banned since 1990. (USEPA. 2012b)

In this region, mercury impairments are found downstream of New Idria Mine, which was the second most productive mercury mine in North America, and in Pine Flat Reservoir and Kaweah Lake (SWRCB. 2010 and USEPA. 2012a). Inorganic mercury enters reservoirs and other water bodies through a variety of sources including atmospheric deposition; through tributary streams carrying runoff from mercury and gold mining sites; from urban and industrial discharges; and from erosion of soils naturally enriched with mercury. Methylmercury is a concern because it bioaccumulates through the aquatic food web to potentially harmful amounts found in larger fish that can be consumed by humans and wildlife. (SWRCB. 2012a)

Molybdenum was found in the Kings River at levels high enough to cause concern for agricultural use. Selenium is a highly bioaccumulative trace element, which, under certain conditions, can be mobilized through the food chain, and cause both acute and chronic toxicity to waterfowl. (CVRWQCB. 2001)

Erosion is one of the greatest problems in the foothills and mountain areas of this region. Erosion is a natural occurrence, but most activities of man accelerate the process. Erosion causes discoloration of streams, and the suspended matter settles to form a smothering blanket on the stream bed. Sedimentation

impairs fisheries and, by virtue of the characteristics of many organic and inorganic compounds to bind to soil particles, it serves to distribute and circulate toxic substances through the riparian, estuarine, and marine systems. Erosion is accelerated by poor drainage and soil stabilization associated with road building, clearing land, leveling land, construction, logging, brush clearing, off-road vehicle use, agriculture, overgrazing and fires. (CVRWQCB. 2004)

Groundwater Quality

Generally, the quality and the beneficial uses of the deep ground waters remain the same as before man entered the valley. A few areas within the Basin have ground waters that are naturally unusable or of marginal quality for certain beneficial uses. (CVRWQCB. 2004) However, anthropogenic sources have impacted many of the shallower zones. Ground water in the shallower part of the aquifer generally contains higher concentrations of anthropogenic contaminants, such as nitrates and pesticides, than the deeper part of the aquifer. The shallower part of the aquifer is generally younger water that indicates more recently recharged water. So, shallower wells, such as domestic supply wells, may provide better indication of pollutants from current land use activities. Pollutants from current land use activities may eventually impact deeper wells such as public supply wells. (Burow. 2008) The following are the contaminants of concern in groundwater for this region:

- Salinity (CVRWQCB. 2004)
- Nitrate (Dubrovsky. 1998, Burow. 2008, CWS. 2012)
- DBCP (1,2-dibromo-3-chloropropane) (Dubrovsky. 1998, Burow. 2008, SWRCB. 2012b)
- Arsenic (SWRCB. 2012b)
- Gross Alpha Particle Activity and Uranium (SWRCB. 2012b)
- Chromium 6 (SWRCB. 2011b)
- Localized contamination by (SWRCB. 2012b):
- Organic Compounds (Benzene, tetrachloroethylene (PCE), trichloroethylene (TCE), and perchlorate)
- Fluoride

Degradation of ground water in the Tulare Lake Basin by salts is unavoidable without a plan for removing salts from the Basin. Some of the salt load to the ground water resource is primarily the result of natural processes within the Basin, but some also occurs due to water imported from other basins to supply agricultural irrigation water. Natural processes include salt loads leached from the soils by precipitation, valley floor runoff, and native surface waters. Salts that are not indigenous to the Basin water resources results from man's activity. Salts come from imported water, soil leached by irrigation, animal wastes, fertilizers and other soil amendments, municipal use, industrial wastewaters, and oil field wastewaters. These salt sources, all contributors to salinity increases, should be managed to the extent practicable to reduce the rate of ground water degradation. (CVRWQCB. 2004)

In a 1998 USGS study, nitrate concentrations in 24 percent (21 of 88) of the domestic wells sampled during 1993–95 in the regional aquifer survey and land-use studies of the eastern San Joaquin Valley exceeded the drinking-water standard of 10 mg/L established by the USEPA. Pesticides were detected in 61 of the 88 domestic wells sampled during 1993–95 (69 percent), but concentrations of most pesticides were low—less than 0.1 mg/L. (Dubrovsky. 1998) A subsequent USGS study found that concentrations of nitrate and pesticides in the shallow part of the aquifer system at depths of domestic wells in the study area have increased over time due to continued contributions of nitrates and current use pesticides in the recharge water. Also, concentrations of nitrates and pesticides in the shallow part of the aquifer are likely

to move to deeper parts of the ground-water flow system. (Burow. 2008) The recent UC Davis report also found that travel times of nitrate from source to wells range from a few years to decades in domestic wells, and from years to many decades and even centuries in deeper production wells. While the quality of the shallower part of the aquifer is the result of past land use activities, the soil profile contains a stockpile of these contaminants that will continue to recharge the shallow aquifer and cause migration of contaminants to the deeper aquifer. Human-generated nitrate sources to groundwater include nitrogen applied to croplands, percolation of wastewater treatment plant and food processing wastes, leachate from septic system drain fields, urban parks, lawns, golf courses, leaky sewer systems, recharge from animal corrals and manure storage lagoons, and downward migration of nitrate-contaminated water via wells. Agricultural fertilizers and animal wastes applied to cropland are by far the largest regional sources of nitrate in groundwater; although, other sources can be locally relevant. (CWS. 2012)

Concentrations of DBCP, a soil fumigant banned since 1977, exceeded the USEPA drinking-water standard of 0.2 mg/L in 18 of the 88 (or 20 percent) domestic wells sampled during 1993–95. (Dubrovsky. 1998.) DBCP concentrations were above the drinking-water standard in 16 of 50 (or 32 percent) of domestic wells samples in orchards and vineyards from 2001-02. (Burow. 2008)

Public supply wells with levels of arsenic in the raw and untreated water that exceed the maximum contaminant level (MCL) were found in the south and western part of the Tulare Lake. Arsenic is generally considered to be naturally occurring. (SWRCB. 2012b) [Recommendation to DWR: Link the arsenic in groundwater with the condition of drinking water from the DPH annual compliance reports. This would give an indication of the ability of the public water system to treat the arsenic. In the drinking water section, this can include a discussion about DPH adopting the MCL in 2008 after an analysis of the number of systems with arsenic in their source water and how successful the systems have been in treating or not treating the arsenic. This can lead to an accomplishment story that the region dealt with its arsenic or that it will be a challenge to come up with funding so that the public water systems can add treatment to address the arsenic.] Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. (USEPA. 2012)

Gross alpha particle activity and uranium were found in raw and untreated water for many of the public water systems in the Tulare Lake Basin. These radionuclides are typically naturally occurring but are a concern because of the potential for health effects. (SWRCB. 2012b)

Chromium is a metal found in natural deposits of ores containing other elements, mostly as chrome-iron ore. It is also widely present in soil and plants. Recent sampling of drinking water throughout California suggests that hexavalent chromium may occur naturally in groundwater at many locations. Chromium may also enter the environment from human uses. Chromium is used in metal alloys such as stainless steel; protective coatings on metal; magnetic tapes, and pigments for paints, cement, paper, rubber, composition floor covering, etc. Elevated levels (above the detection limit of 1 µg/l) of hexavalent chromium have been detected in many active and standby public supply wells along the west or valley floor portion of the Central Valley. (SWRCB. 2011b)

Benzene, perchlorate, tetrachloroethylene (PCE) and trichloroethylene (TCE) have been detected at levels exceeding MCLs in the source water of a few water systems in the Tulare Lake Hydrologic Region. Benzene was found in public supply wells in Arvin and Kettleman City. Perchlorate was found in wells in Tehachapi, Stallion Springs, East Tulare and Exeter. PCE was found in public supply wells in the Fresno

metropolitan area, Sanger, Arvin, Golden Hills, Oildale, Bakersfield and Goshen areas. TCE was found in the Fresno and Bakersfield metropolitan areas. (SWRCB. 2012b) Benzene and perchlorate occur in the environment both naturally and due to man-made sources. PCE was the main solvent used for dry cleaning. Its occurrence in the environment is also associated with textile operations and metal degreasing operations. TCE is most associated with metal degreasing operations.

Fluoride was found at levels exceeding MCLs in raw and untreated water in the Sierra and San Emigdio Mountains areas of Kern County. (SWRCB. 2012b) While fluoride is added to public drinking water supplies as a public health measure for reducing cavities among the treated population, it can also occur naturally as a result of the geological composition of soils and bedrock. (USEPA. 2011)

Drinking Water Quality

In general, drinking water systems in the region deliver water that meets federal and state drinking water standards. However, there are some small community water systems in the region that fail to meet drinking water standards. Most of these water systems serve disadvantaged communities, and most are seeking financial assistance from State and Federal agencies to find viable solutions to correct their problem. A major obstacle in finding a viable solution is the affordability of operation and maintenance costs associated with the selected solution. These additional costs can sometimes double or triple the water rates and which may be unaffordable for rate payers in disadvantaged communities.

Recently the Water Boards completed a draft statewide assessment of community water systems that rely on contaminated groundwater. Contamination of local groundwater resources results in higher costs for rate payers and consumers due to the need for additional water treatment. This draft report identified 146 community drinking water systems in the region that rely on at least one contaminated groundwater well as a source of supply (See Table TL-17). A total of 329 community drinking water wells are affected by groundwater contamination, and the most prevalent contaminants are arsenic, nitrate, gross alpha particle activity, 1,2-Dibromo-3-chloropropane (DBCP), and uranium (See Table TL-18). The majority of the affected systems are small water systems which often need financial assistance to construct a water treatment plant or alternate solution to meet drinking water standards.

In addition to the Water Boards draft study, UC Davis completed a study in 2012 on nitrate contamination affecting drinking water systems in the Tulare Lake Basin and Salinas Valley. The study found that in the Tulare Lake Basin the largest percentage of nitrate MCL exceedances is in the eastern portion of the basin (Harter et al., 2012.).

PLACEHOLDER Table TL-17 Summary of Community Drinking Water Systems in the Tulare Lake Hydrologic Region That Rely on One or More Contaminated Groundwater Well That Exceeds a Primary Drinking Water Standard

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

PLACEHOLDER Table TL-18 Summary of Contaminants Affecting Community Drinking Water Systems in the Tulare Lake Basin Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Groundwater Level Trends and Issues

Describe the aquifer conditions, such as overdraft, loss of recharge areas, and issues that may be occurring with relationship to the available supply of water in the aquifer, including threats such as contaminant plumes. This section could potentially be combined with groundwater quality, above, at the author's discretion.

[Placeholder groundwater text. Contains:

- Key long-term groundwater level hydrographs for the Hydrologic Region with description of seasonal and long-term groundwater level trends and aquifer response to demand during wet, normal, and dry hydrologic conditions.
- Description of estimated annual change in groundwater in storage for 2005-2010, and for each pair of consecutive years (e.g., 2005-2006, 2006-07, etc.). For Hydrologic Regions where data are not available in DWR's Water Data Library or limited, identify this as a data gap.
- Map showing location of groundwater basins and associated change contours of groundwater levels and storage, subject to availability of information.
- Chart showing trends in annual and cumulative change in groundwater in storage, subject to availability of information.
- Table containing values for annual and cumulative change in groundwater levels and storage, subject to availability of information.
- Discussion and presentation of results from other related efforts for the Hydrologic Regions to estimate change in groundwater in storage, based on availability of data and information. These efforts may include local and regional agency groundwater modeling results and results from GRACE satellite analysis.
- Discussion of the historic land subsidence for the Hydrologic Region and the potential susceptibility for the future, if pertinent to the Hydrologic Region and subject to availability of data.
- General overview of aquifer sustainability based on above data and existing groundwater management practices. More detailed trends and assessment of sustainability indicators for Hydrologic Regions for which data or modeling results are available.]

Flood Management

Traditionally, the approach to flood management was to develop narrowly focused flood infrastructure projects. This infrastructure often altered or confined natural watercourses, which reduced the chance of flooding thereby minimizing damage to lives and property. This traditional approach looked at floodwaters primarily as a potential risk to be mitigated, instead of as a natural resource that could provide multiple societal benefits.

Today, water resources and flood planning involves additional demands and challenges, such as multiple regulatory processes and permits, coordination with multiple agencies and stakeholders, and increased environmental awareness. These additional complexities call for an Integrated Water Management approach, that incorporates natural hydrologic, geomorphic, and ecological processes to reduce flood risk by influencing the cause of the harm, including the probability, extent, or depth of flooding (flood hazard). Some agencies are transitioning to an IWM approach. IWM changes the implementation approach based on the understanding that water resources are an integral component for sustainable ecosystems, economic growth, water supply reliability, public health and safety, and other interrelated

elements. Additionally, IWM acknowledges that a broad range of stakeholders might have interests and perspectives that could positively influence planning outcomes.

For example, in Tulare County, the Paregien Basin Project consists of a 78-acre groundwater recharge basin, associated structures and monitoring wells that would capture floodwaters for groundwater recharge.

Risk Characterization

Significant geographic features include the southern half of the San Joaquin Valley where Tulare Lake is located. Other major features include the Temblor Range to the west, the Tehachapi Mountains to the south, and the southern Sierra Nevada to the east all surrounding the valley allowing no outlet to the sea. For this reason the area naturally drains to the Tulare, Buena Vista, and Kern lakebeds (natural drainage sinks converted to agricultural areas). Major lakes and reservoirs include Pine Flat Lake, Lake Kaweah, Lake Success, and Lake Isabella. Major streams and rivers include Kings, Kaweah, Tule, and Kern rivers. Major cities include Bakersfield, Visalia, Fresno, Clovis, Tulare, and Delano.

Floods in the Tulare Lake Hydrologic Region can be caused by heavy rainfall; by dams, levees, or other engineered structures failing; or by extreme wet-weather patterns. Historically, in the Tulare Lake Hydrologic Region flooding originates principally from melting of the Sierra snowpack and from rainfall. Flooding from snowmelt typically occurs in the spring and has a lengthy runoff period. Flooding from rainfall occurs in the winter and early spring, particularly when storms arriving from the Gulf of Alaska draw moisture-laden air from the tropics. This pattern is known as an Atmospheric River. Extreme events occur when an atmospheric river events occurs in the early spring causing snow to melt, exacerbating runoff from the rainfall.

Historic Floods

Historically, flooding in the hydrologic region was intermittent, with severe flooding some years and drought in other years. Flash and slow-rise flooding are the most commonly experienced types of flooding in this hydrologic region. Floods that occur in the Tulare Lake Hydrologic Region take a variety of forms and can be classified into flash, alluvial fan, debris flow, stormwater, slow-rise, and engineered structure failure flooding. For a complete record of floods, refer California Flood Future Report Attachment C: Flood History of California Technical Memorandum.

Major flood events in the Tulare hydrologic region include:

- In December 1955 through January 1956, a storm caused by a family of cyclones from the mid-Pacific Ocean that poured rain and induced snowmelt on low elevations of the Tulare Lake Hydrologic Region, inundating 183,000 acres of mostly agricultural land and the towns of Visalia, Three Rivers, and Exeter.
- In 1966 and 1967 region-wide floods claimed three lives and inundated about 142,000 acres.
- In early 1969, heavy precipitation plus a prodigious snowpack melt in January and February caused flooding throughout the region and reinundated 89,000 acres in the bed of Tulare Lake.
- In January 1997, heavy precipitation flooded the region, causing a levee on the Tule River to break, which submerged 50,000 acres of agricultural lands in the bed of Tulare Lake. In 1998, a heavy snowpack and warm rains produced flooding of the White River that inundated the city of Earlimart and closed U.S. 99 for a week.

- In January of 1997, heavy precipitation flooded the region, causing a levee on the Tule River to break, which submerged 50,000 acres of agricultural lands in the Tulare Lake bed. A list of recorded major flood events in the Tulare Lake Hydrologic Region is provided

Damage Reduction Measures

Floods in the Tulare Lake Hydrologic Region occur generally as a result of winter storms and summer thunderstorms. Two levels of flood events are commonly used to characterize flooding:

- 100-Year Flood is a shorthand expression for a flood that has a 1 in-100 probability of occurring in any given year. This can also be expressed as the 1 percent annual chance of, or “1 percent annual chance flood.”
- 500-Year Flood has a 1-in-500 (or 0.2 percent) probability of occurring in any given year.

In the Tulare Lake Hydrologic Region, nearly 500,000 people and more than \$32 billion in assets are exposed to the 500-year flood event. The Tulare Lake Hydrologic Region has the most crop value exposed (more than \$2.3 billion) to the 500-year flood. Table TL-19 provides a snapshot of people, structures, crops, infrastructure, and sensitive species exposed to flooding in the region. Threatened or endangered plant and animal species exposed to flood hazards are distributed throughout the Tulare Lake Hydrologic Region. Table TL-19 lists the number of sensitive species exposed to flood hazards in 100-year and 500-year events.

PLACEHOLDER Table TL-19 Tulare Lake Hydrologic Region Exposures within the 100-Year and 500-Year Floodplains

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Levee Performance and Risk Studies

Flood Hazard mitigation planning is an important part of emergency management planning for floods and other disasters. Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Hazard Mitigation Planning is the process through which natural hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies that would lessen the impacts are determined, prioritized, and implemented. Hazard Mitigation Planning is required for state and local governments to maintain their eligibility for certain Federal disaster assistance and hazard mitigation funding programs.

Multi-Hazard Mitigation Plans (MHMPs) are required by FEMA as a condition of pre- and post-disaster assistance. The Stafford Act, as amended by the Disaster Mitigation Act of 2000, provides for states, tribes, and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning. The National Flood Insurance Act reinforced the need and requirement for mitigation plans linking flood mitigation assistance programs to state, tribal, and local mitigation plans. FEMA-approved MHMPs were identified or collected for Kern and Kings Counties. Other risk assessment studies were prepared by various entities including USACE, FEMA, and the State Reclamation Board of California. For a complete list of studies, refer to California’s Flood Future Report Attachment G: Risk Information Inventory Technical Memorandum.

In the Tulare Lake Hydrologic Region, thirty local flood management projects or planned improvements were identified. Twenty-seven of those projects have costs totaling approximately \$240 million while the remaining projects do not have costs associated with them at this time. The local flood management projects for the Tulare Lake Hydrologic Region are listed in California's Flood Future Report Attachment E: Information Gathering Technical Memorandum. Eighteen local planned projects use an Integrated Water Management (IWM) approach. Examples of local IWM projects include the Eastside Water Quality and Urban Reliability Project in Fresno County and Caliente Creek Habitat Restoration - Feasibility Study in Kern County. For a complete list of projects, refer to California's Flood Future Report Attachment G: Risk Information Inventory Technical Memorandum.

Current Relationships with Other Regions and States

[This subsection contains a discussion of the following topics.]

- The status and magnitude of current relationships.]

[Considerations for this subsection:

- Water imports/exports.
- Flood management.
- Recreation/tourism.]

Implementation Activities (2009-2013)

[This subsection contains a discussion of the actions that have been taken since the last California Water Plan update to meet the water challenges in the region.]

[Considerations for this subsection:

- The efforts we will be doing for the progress report format should provide some content for this section. We should not, however, be limited to the progress report if significant activities have occurred in the region since the last update.]

Water Board Implementation

The Regional Water Boards are responsible for protecting the water quality of the waters of the state and have regulatory and non-regulatory programs that can address the water quality concerns of this area. The Water Boards adopt water quality control plans or basin plans that lay out the framework for how the Board will protect water quality in each region. The basin plans designate the beneficial uses of surface and ground water in the region, water quality objectives to meet the beneficial uses and establish an implementation program to achieve the water quality objectives and protect the beneficial uses. The implementation program describes how the Board will coordinate its regulatory and non-regulatory programs to address specific water quality concerns.

Overarching all the Central Valley Water Board's programs and activities is the development of a comprehensive salt and nitrate management plan for the Central Valley. The Central Valley Water Board and the State Water Board, as part of a stakeholder coalition, are working on Salinity Alternatives for Long-Term Sustainability (CV-SALTS), which is a strategic initiative to address problems with salinity and nitrates in the surface waters and ground waters of the Central Valley. The long-term plan developed under CV-SALTS will identify and require discharger implementation of management measures aimed at the reduction and/or control of major sources of salt and nitrate as well as support activities that alleviate

known impairments to drinking water supplies. The eventual salt and nitrate management plan will provide guidance across all the Central Valley Water Board's regulatory and non-regulatory programs on how to address salinity and nitrate concerns. As this issue impacts all users (stakeholders) of water within the Tulare Lake Hydrologic Region, it is important that all stakeholders participate in CV-SALTS to be part of the development and have input on the implementation of salt and nitrate management within the Tulare Lake area. For the Central Valley, the only acceptable process to develop the salt and nutrient management plans that are required under state policy (SWRCB. 2009) is through CV-SALTS.

CV-SALTS will include basin plan amendments that establish regulatory structure and policies to support basin-wide salt and nitrate management. The regulatory structure will have four key elements: (1) refinement of the agricultural supply (AGR), municipal and domestic supply (MUN) and groundwater recharge (GWR) beneficial uses; (2) revision of water quality objectives for these uses; (3) establishment of policies for assessing compliance with the beneficial uses and water quality objectives; and (4) establishment of management areas where there are large scale differences in baseline water quality, land use, climate conditions, soil characteristics and existing infrastructure and where short and long term salt and/or nitrate management is needed. For the Tulare Lake Hydrologic Region, CV-SALTS plans to implement pilot projects to demonstrate refinement of beneficial uses in the groundwater in the Tulare Lake Bed; beneficial uses and water quality objectives for agricultural water bodies; and development of a management plan to assist areas with inadequate economic capacity to address high levels of nitrate contamination in drinking water. (CV-SALTS. 2012a and CV-SALTS, 2012b) CV-SALTS is coordinating and building off the salinity reduction and control efforts described under the Accomplishments section.

Surface Water

The Central Valley Water Board has regulatory programs to protect and restore the quality of surface waters. These programs include:

- The Irrigated Lands Regulatory Program regulates discharges from irrigated agriculture through surface water monitoring and the development and implementation of management plans to address water quality problems identified in the surface water monitoring. This program addresses materials used in agricultural production that may end up in surface water, such as pesticides as well as pollutants that may be concentrated or mobilized by agricultural activities such as salt. In this program, coalition groups representing growers monitor to identify constituents of concern. Management plans are developed which identify management practices that individual growers implement to reduce the concentrations of the constituents of concern in surface water. Follow-up monitoring is conducted to confirm that water quality standards are met. Growers work together under a coalition group to meet the program requirements. Water quality coalitions currently active in the Region are the Westlands Water District and Southern San Joaquin Valley Water Quality Coalition. Management plans have been developed and implemented to address water column and sediment toxicity and E. coli. (CVRWQCB. 2011a)
- In the west side of the Tulare Lake Hydrologic Region, there are farm lands with naturally poor drainage. In these areas, there is a need for agricultural subsurface collection systems (tile drains) that are placed below the root zone of crops to drain water from soils that would otherwise stay saturated. Through evaporation and crop transpiration, the tile drain water has salt levels that are many times higher than the salt levels in the applied water. Also through evaporation and crop transpiration, the tile drains concentrate trace elements found naturally in the soils to levels that are a concern to wildlife. In some areas of the Basin, evaporation basins

are used to collect and concentrate the tile drainage. The Irrigated Lands Regulatory Program oversees the operations at these evaporation basins to assure that they do not adversely impact wildlife or other beneficial uses. (CVRWQCB. 2004)

- The Discharge to Land Program oversees the investigation and cleanup of impacts of current and historic unauthorized discharges including discharges from historic mining activities. Historic mine impacts include mercury impairments from mercury mines found on the Coast Range side of the Central Valley and mercury impairments from the use of mercury to amalgamate gold in the mines on the Sierra side.
- The National Pollutant Discharge Elimination System (NPDES) permit program regulates the discharge of point source wastewaters and urban runoff to surface waters. Point source wastewater can contain elevated levels of salt and nitrates, pesticides, mercury and other metals. Urban runoff can contain pesticides, mercury and other metals, and sediment. Permits prevent the discharge of elevated concentrations of these constituents. In cases where elevated levels of constituents of concern are being discharged, permits require dischargers to develop and implement measures to reduce the levels of these constituents.
- The Water Quality Certification Program evaluates discharges of dredge and fill materials to assure that the activities do not violate state and federal water quality standards.
- The Nonpoint Source program supports local and regional watershed assessment, management, and restoration to enhance watershed conditions that provide for improved flow properties and water quality. Nonpoint sources include agriculture, forestry, urban discharges, discharges from marinas and recreational boating, hydromodification activities and wetlands, riparian areas and vegetated treatment systems. For some of these sources, such as irrigated agriculture and forestry, the Central Valley Water Board has specific regulatory programs. The Nonpoint Source Program addresses sources where the Central Valley Water Board has not developed a specific program. This program has assisted stakeholders obtain funding to address nonpoint source pollution as well as conduct riparian and habitat restoration activities. Impacts from recreational activities, such as off highway vehicle (OHV) use, fall under this program.

Groundwater

The Central Valley Water Board has regulatory programs meant to prevent groundwater contamination by controlling the quality of discharges to land. In cases where groundwater quality has been affected, the Water Board's Cleanup programs work with the entities responsible for the contamination to assess the extent of contamination, and develop and implement a plan to clean up the contamination. The Central Valley Water Board has developed programs that regulate specific discharge types when there are a large number of dischargers of that type and the water quality of the discharge is similar. The following are programs addressing specific discharge types (CVRWQCB. 2010b):

- The Central Valley Water Board has a program to regulate discharges from confined animal operations. Water quality issues associated with confined animal operations are salt and nutrients. In 2007, the Central Valley Water Board adopted Waste Discharge Requirements General Order for Existing Milk Cow Diaries (R5-2007-0035) which includes requirements for both the dairy production area and land application area and requires each dairy to fully implement their Waste Management Plan by 2011 and Nutrient Management Plan by 2012. [When the Water Plan is updated, these dates will be in the past, so we should include a status report on the number (percentage) of dairies in compliance.] The requirements for the Waste and Nutrient Management Plans are designed to protect both surface and ground water. In the

Tulare Lake Hydrologic Region, there are 559 dairies with over 919,000 cows regulated under this general order.

- The Central Valley Water Board's Irrigated Lands Regulatory Program, which has been focused on surface water, has been transitioning to a long-term program that will address both surface and groundwater. Irrigated lands may be a source of salt, nitrates and pesticides to ground water.
- The State Water Board has adopted regulations for the operation of onsite wastewater treatment systems. (Resolution 2012-xxx) Water quality concerns associated with individual disposal systems include salt, nitrates and pathogens. The Central Valley Water Board plans to update its guidelines and establish a program based on the new regulations. In the past, the Central Valley Water Board has prohibited discharge in problematic service areas. In the Tulare Lake Hydrologic Region, the Central Valley Water Board has adopted four prohibitions of discharge from individual sewage disposal systems. Currently, all of these areas are served by community sewage systems.
- The Discharge to Lands program provides oversight of the discharges from oil fields. In the Central Valley, the only oil fields are located in the Tulare Lake Basin. Produced water from the extraction of oil is a water quality concern due to high levels of salt, oil and grease, metals and organics. Discharge to surface waters is allowed with higher quality produced water which is used directly or blended with other waters for agricultural supply. Discharge to sumps is allowed when the quality meets basin plan requirements. Produced water is also re-injected into aquifers that have received an exemption pursuant to 40 CFR section 261.3.
- The Central Valley Water Board has established the Groundwater Monitoring Advisory Workgroup (GMAW) whose primary goal is to provide input on matters related to groundwater monitoring. Specifically, the GMAW will advise and provide comments to Central Valley Water Board staff on technical issues related to how groundwater monitoring studies are conducted and evaluation of monitoring data.

Drought Contingency Plans

[Include a description of drought-related contingency planning that has occurred since the last California Water Plan update.]

[Placeholder groundwater text. Contains:

- Description of components of the local drought contingency plans that call for increased groundwater use via groundwater substitution water transfers or other conjunctive management practices, if pertinent to the Hydrologic Region.]

Resource Management Strategies

[Provide a description of any initiative or action that has taken place to implement any of the more than 27 resource management strategies during the period of this California Water Plan update (2009-2013).]

[Placeholder groundwater text. Contains:

- Brief summary of DWR/ACWA joint survey and DWR's follow-up email and phone communications to conduct a survey to gather information on conjunctive management projects in the state.
- Description of the groundwater related conjunctive management projects for the Hydrologic Region.

- Table listing the conjunctive management projects.
- Dot Map showing location of the conjunctive management projects.
- Table showing responses on survey questions on conjunctive management projects.
- Charts showing projects by year project started, source of water, method of recharge, program goals, and potential constraints to conjunctive management, and other survey responses.
- Discussion on potential for conjunctive management in the Hydrologic Region subject to available aquifer space, source water, and infrastructure (conveyance, infiltration/injection, and extraction).
- Discussion on potential constraints to conjunctive management in the Hydrologic Region, including aquifer space, supply source, infrastructure, environmental, legal, regulatory, water quality, etc.]

Salt and Salinity Management

In March 2010, a Memorandum of Agreement (MOA) was finalized between Central Valley Regional Water Quality Control Board, Central Valley Salinity Coalition (a legal stakeholder entity), and the State Water Resources Control Board that documents the roles and responsibilities of the parties to coordinate salinity planning, management and regulation throughout the Central Valley in order to insure a sustainable future. The State Water Board provided \$5-million in seed money that is being matched by stakeholder contributions. Some activities completed to date to help develop a sustainable salt and nitrate management plan include: pilot studies to document water balances and salt and nitrate source and fate (between 2009 and 2011), initiation of a management practices tool box that assists dischargers in identifying practices that will help reduce salt and nitrate impacts (2010); initiation of a conceptual model to prioritize management areas for detailed study and implementation plans (2012); coordination with disadvantaged communities within the Tulare Lake Basin to identify early implementation projects to provide safe drinking water to groups impacted by elevated nitrate in groundwater (2012); and development of a long term funding plan (2012).

Water Governance

[Describe any changes made to the water governance in the region since the last California Water Plan update. This would include any joint powers agreements and IRWM groups formed.]

[Placeholder groundwater text. Contains:

- Brief description of the groundwater governance associated with the various GWMPs, IRWMPs, conjunctive management projects, groundwater recharge projects, groundwater monitoring, groundwater ordinances, and adjudicated groundwater basins within the Hydrologic Region.
- Table listing the above groundwater-related governance within the Hydrologic Region.
- Maps showing area coverage for GWMPs and IRWMPs, and “dot” locations of groundwater ordinances, adjudicated basins, and conjunctive management projects.
- Groundwater basin prioritization maps showing high, medium and low priority basins.]

Flood Management Governance and Laws

Water Code Division 5, Sections 8,000 - 9,651 has special significance to flood management activities and is summarized in California’s Flood Future Report Attachment E: Information Gathering Technical Memorandum.

Recently, a number of laws regarding flood risk and land use planning were enacted in 2007. These laws establish a comprehensive approach to improving flood management by addressing system deficiencies, improving flood risk information, and encouraging links between land use planning and flood management. My. Two of the Assembly Bills (AB) that the California legislature passed are summarized below.

- AB 70 (2007) Flood Liability — provides that a city or county might be responsible for its reasonable share of property damage caused by a flood, if the State liability for property damage has increased due to approval of new development after January 1, 2008.
- AB 162 (2007) General Plans — requires annual review of the land use element of general plans for areas subject to flooding, as identified by FEMA or DWR floodplain mapping. The bill also requires that the safety element of general plans provide information on flood hazards. Additionally, AB 162 requires the conservation element of general plans to identify rivers, creeks, streams, flood corridors, riparian habitat, and land that might accommodate floodwater for purposes of groundwater recharge and stormwater management.

State Funding Received

[Describe the State funding received to implement water-related infrastructure, coordination, or planning in the region.]

Local Investment

[Describe the local investment made to implement water-related infrastructure, coordination, or planning in the region.]

Water Conservation Act of 2009 (SB x7-7) Implementation Status and Issues

[Provide a discussion of the status and major issues with implementation of the Water Conservation Act of 2009 for both urban and agricultural water conservation.]

The only portion of the Water Conservation Act of 2009 that has been implemented is the submittal of a 2010 update of Urban Water Management Plans (UWMPs). Table TL-20 shows which urban water suppliers have submitted their 2010 UWMP updates.

PLACEHOLDER Table TL-20 List of 2010 Urban Water Management Plan Updates by Urban Water Supplier

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Interregional and Interstate Activities

[Describe those interregional and interstate activities that have occurred since the last California Water Plan update.]

[Placeholder groundwater text. Contains:

- Description of interregional and interstate water resource planning activities that have identified increase use of groundwater in their planning (interstate examples include Klamath Basin for the North Coast Hydrologic Region, and the Honey Lake Basin for the North Lahontan Hydrologic Region).]

Looking to the Future

[Notes: (1) Although the regional forums may seek consensus on objectives for the entire hydrologic region, this section will likely be a compilation of the IRWM and other local plan objectives. (2) Reference statewide priorities or IRWM guidelines to ensure consistency. (3) Because no single resource management strategy can meet the broad set of resource management objectives, this section is meant to shift planning approach/discussions from focusing on specific types of resource management strategies (e.g., desalination vs. conservation vs. storage, etc.) to an objectives-based planning approach.]

Ecosystem Priorities

This list provides a list of some of the priority areas and needs specific to the Tulare Lake Hydrologic Region from a DFG perspective for California, in relation to California water supply.

- Acquisition of conservation easements on lands;
- Protect or restore fish habitat through the improvement of fish passage conditions, gravel augmentation, hydrology, fish screens, min/max flow, etc...;
- Restoration or modification to allow for a more natural regime of hydrology and hydraulics;
- Improvements or modifications to existing water conveyance for habitat and water for ecosystem use;
- Development, collection and publication of instream flow data, including recommended instream flow levels and minimum instream flow requirements;
- Prevent or reduce negative impacts from invasive non-native species including those associated with water supply and conveyance projects such as quagga and zebra mussels, *Egeria densa*, water hyacinth, and others;
- Restoration of riparian habitat, including conservation of riparian corridors;
- Water quality improvements (sediment, oxygen saturation, pollution, temperature, etc...) to support healthy ecosystems;
- Restoration projects that improve upon existing wetlands, or create new wetlands in appropriate areas;
- And, restoration, preservation, and protection of wildlife corridors.

Future Conditions

Future Scenarios

[This subsection contains a discussion of the following topic. (Primary authors would be from the analytical data and tools work team.)]

- Water demand by sector for future scenarios.]

[Considerations for this subsection:

- How do the three future scenarios relate to regionally derived future plans/visions? This might be the best place to examine compatibilities and contrasts of local and state objectives.
- Regional estimates regarding future agricultural, urban, and environmental water demands; economic development; flood management; land use; etc.]

Climate Change

Climate change is already impacting many resource sectors in California, including water, transportation and energy infrastructure, public health, biodiversity, and agriculture (USGRCP, 2009; CNRA, 2009).

Climate model simulations using the Intergovernmental Panel on Climate Change's 21st century scenarios project increasing temperatures in California, with greater increases in the summer. Projected changes in annual precipitation patterns in California will result in changes to surface runoff timing, volume, and type (Cayan, 2008). Recently developed computer downscaling techniques indicate that California flood risks from warm-wet, atmospheric river type storms may increase beyond those that we have known historically, mostly in the form of occasional more-extreme-than-historical storm seasons (Dettinger, 2011).

While the State of California is taking aggressive action to mitigate climate change through greenhouse gas (GHG) reduction and other measures (CARB, 2008), global impacts from carbon dioxide and other GHGs that are already in the atmosphere will continue to impact climate throughout the rest of the century (IPCC, 2007; UNEP, 2009). Resilience to an uncertain future can be achieved by implementing adaptation measures sooner rather than later. Due to the economic, geographical and biological diversity of the state, vulnerabilities and risks due to current and future anticipated changes are best assessed on a regional basis. Many resources are available to assist water managers and others in evaluating their region-specific vulnerabilities and identifying appropriate adaptive actions (EPA/DWR, 2011; Cal-EMA/CNRA, 2012).

Regional Temperature Trends

The Western Regional Climate Center (WRCC) has temperature and precipitation data for the past century. Two WRCC regions overlap with the Tulare Lake Hydrologic Region - the Sierra and San Joaquin Valley regions. Temperatures in the WRCC San Joaquin Valley region show a mean increase of 0.9-1.9 °F (0.5-1.0 °C), with minimum temperatures increasing 2-3 °F (1.1-1.6 °C) compared to the mean maximum temperature trend, which was relatively stable. The WRCC Sierra region also had an increasing mean temperature trend of 0.8-1.9 °F (0.4-1.1 °C), and again more warming was observed at night than in daytime [1.7-2.7 °F (0.9-1.5 °C) compared to -0.3-1.3 °F (-0.2-0.7 °C)].

Temperature and Precipitation Projections

Temperature projections are in wide agreement on a warming trend statewide. Future impacts by 2050 in the Tulare Lake Hydrologic Region are projected to include increased average temperatures (especially at night and in winter) and a continued decline in snowpack in the Sierra Nevada, although high altitude areas were serve as a “snowpack refugium” for this region. Under a high emissions scenario, temperatures by 2050 in the Tulare Lake Hydrologic Region are projected to increase as much as 3-4 °F (1.7-2.2 °C) in winter and 5-6 °F (2.8-3.3 °C) in summer, and 4-6 °F (2.2-3.3 °C) in winter and 7.5-10 °F (4.2-5.6 °C) in summer months by the end of the century. A recent highly sophisticated study of projected temperatures for 2070 indicates that the region could experience 4.1 °F (2.3 °C) increase overall, with an increase of 3.2 °F (1.8 °C) in mean winter temperatures and 5.2 °F (2.9 °C) in summer (Pierce et.al., 2012). Heat waves, defined as temperatures over 100 °F (55.6 °C), are expected to increase three to five times by 2050 and seven to ten times by 2100 (Cal-EMA/CNRA, 2012).

Extreme precipitation events are projected to increase with climate change (Dettinger, 2012). Changes in annual precipitation across California, either in timing or total amount, will result in changes in type of precipitation (rain or snow) in a given area, and to surface runoff timing and volume. Most climate model precipitation projections for the State anticipate drier conditions in southern California, with heavier and warmer winter precipitation in northern California. More intense wet and dry periods are anticipated, which could lead to flooding in some years and drought in others. Since there is less scientific detail on

localized precipitation changes, there exists a need to adapt to this uncertainty at the regional level (Leung, 2012).

Flood Risk

A recent study that explores future climate change and flood risk in the Sierra using downscaled simulations (computer projections refined to a scale smaller than global models), from three global climate models (GCMs) under a GHG scenario which is reflective of current trends, indicates a tendency toward increased 3-day flood magnitude. By the end of the 21st century, all three projections yield larger floods for both the moderate elevation northern Sierra Nevada watershed and for the high elevation southern Sierra Nevada watershed, even for GCM simulations with 8–15% declines in overall precipitation. The increases in flood magnitude are statistically significant for all three GCMs for the period 2051–2099. By the end of the 21st century, the magnitudes of the largest floods increase to 110% to 150% of historical magnitudes. These increases appear to derive jointly from increases in heavy precipitation amount, storm frequencies, and days with more precipitation falling as rain and less as snow. The frequency of floods by the end of this century increased for two of the models, but remained constant or declined for the third model (Das et al., 2011).

Ecosystem Services and Agriculture

Changes in climate and runoff patterns may create increased competition among sectors that utilize water. The region is economically dependent on a thriving agricultural industry, which will be affected by a more variable hydrologic regime, reduced chill-hours in winter, increased evapotranspiration, and other indirect effects of rising temperatures. In some instances a longer growing season will be beneficial, but productivity of stone-fruit and nut trees may decline. The dairy industry will be affected by a anticipated increase in extreme heat days and reduced water availability (Cal-EMA/CNRA, 2012). Agricultural water use efficiency will become increasingly important under these conditions. Additional climate change impacts will occur in surrounding watersheds. Wildfires in the Sierra foothills may increase in number and intensity (Westerling, 2008), impacting habitat and water quality in the region.

Adaptation

Local agencies, as well as federal and state agencies, face the challenge of interpreting new information and determining which methods and approaches are appropriate for their planning needs. The *Climate Change Handbook for Regional Water Planning* (EPA/DWR, 2011) provides an analytical framework for incorporating climate change impacts into a regional and watershed planning process and considers adaptation to climate change. This handbook provides guidance for assessing the vulnerabilities of California's watersheds and regions to climate change impacts, and prioritizing these vulnerabilities.

Additional Tools and Resources

The State of California has developed additional tools and resources to assist resource managers and local agencies in adapting to climate change, including:

- *California Climate Adaptation Strategy* (2009) - California Natural Resources Agency (CNRA) at: <http://www.climatechange.ca.gov/adaptation/strategy/index.html>
- *California Climate Change Adaptation Planning Guide* (2012) - California Emergency Management Agency (Cal-EMA) and CNRA at: http://resources.ca.gov/climate_adaptation/local_government/adaptation_planning_guide.html
- Cal-Adapt website at: <http://cal-adapt.org/>

- Urban Forest Management Plan (UFMP) Toolkit - sponsored by the California Department of Forestry and Fire Management at: <http://ufmptoolkit.com/>
- California Climate Change Portal at: <http://www.climatechange.ca.gov/>
- DWR Climate Change website at: <http://www.water.ca.gov/climatechange/resources.cfm>
- The Governor's Office of Planning and Research (OPR) website at: http://www.opr.ca.gov/m_climatechange.php

Strategies

The myriad of resources and choices available to managers can seem overwhelming, and the need to take action given uncertain future conditions is daunting. However, there are many 'low-regrets' actions that water managers in the Tulare Lake region can take to prepare for climate change, regardless of the magnitude of future warming (GEOS/LGC, 2011). These actions often provide economic and public health co-benefits. Water and energy conservation are examples of strategies that make sense with or without the additional pressures of climate change. Conjunctive management projects that manage surface and groundwater in a coordinated fashion could provide a buffer against variable annual water supplies. Forecast-coordinated operations could provide flexibility for water managers to respond to weather conditions as they unfold.

Many of the Resource Management Strategies from California Water Plan Update 2009 (Volume 3) provide benefits for adapting to climate change in addition to meeting water management objectives.

These include:

- Agricultural/Urban Water Use Efficiency;
- Conveyance – Regional/local;
- System Reoperation;
- Conjunctive Management and Groundwater Storage;
- Precipitation Enhancement;
- Surface Storage – Regional/Local;
- Pollution Prevention;
- Agricultural Land Stewardship;
- Ecosystem Restoration;
- Forest Management;
- Land Use Planning and Management;
- Recharge Area Protection;
- Watershed Management
- Flood Risk and Integrated Flood Management

The Tulare Lake Hydrologic Region contains a diverse landscape with different climate zones, making it difficult to find one-size-fits-all adaptation strategies. Water managers and local agencies must work together to determine the appropriate planning approach for their operations and communities. While climate change adds another layer of uncertainty to water planning, it does not fundamentally alter the way water managers already address uncertainty (EPA/DWR, 2011). However, stationarity (the idea that natural systems fluctuate within an unchanging envelope of variability) can no longer be assumed, so new approaches will likely be required (Milly, et.al., 2008). Whatever approach is used, it is necessary for water managers and communities to start implementing adaptation measures sooner than later in order to be prepared for an uncertain future.

Local Planning

Integrated Regional Water Management (IRWM) planning is a framework that allows water managers to address climate change on a smaller, more regional scale. Climate change is now a required component of all IRWM plans (DWR, 2010). IRWM regions must identify and prioritize their specific vulnerabilities, and identify adaptation strategies that are most appropriate for sub-regions. Planning strategies to address vulnerabilities and adaptation to climate change should be both proactive and adaptive, starting with low-regrets strategies that benefit the region in the present-day while adding future flexibility and resilience under uncertainty.

Water managers will need to consider both the natural and built environments as they plan for the future. Stewardship of natural areas and protection of biodiversity are critical for maintaining ecosystem services important for human society such as carbon sequestration, pollution remediation, and habitat for pollinators. Increased cross-sector collaboration between water managers, land use planners and ecosystem managers provides opportunities for identifying common goals and actions needed to achieve resilience to climate change and other stressors.

Mitigation

This is the first California Water Plan to include specific energy intensity information related to water. There is a need to mitigate for climate change by reducing the greenhouse gas (GHG) emissions related to water usage, and comparing energy intensity of various water supplies when making portfolio choices. While both adaptation and mitigation are needed to manage risks and are often complementary and overlapping, there may be unintended consequences if efforts are not coordinated.

When making water management choices, the energy intensity of individual supplies can become part of the decision making process. Figure TL-4 indicates relative energy intensity of raw water extraction and conveyance for the primary water supply sources for this region (caption and footnotes under development). It provides a tool to assist decision making in water management regarding water and energy efficiency and to help evaluate what type of water supply portfolio should be used to meet demand within the hydrological region.

PLACEHOLDER Figure TL-4 Relative Energy Intensity of Water Supply Sources

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of the chapter.]

Interregional and Interstate Planning Activities

[This subsection contains a discussion of the following topics.]

- A summary of relevant planning or implementation activities that will affect this region.
- Regional stake in process.
- Strategies for regional self-sufficiency: Define goals and purpose of self-sufficiency.]

[Considerations for this subsection:

- Consider listing Update 2009 objectives to reflect statewide objectives/vision:
 - Reduce Water Demand.
 - Improve Operational Efficiency and Transfers.
 - Increase Water Supply.

- Improve Water Quality.
- Practice Resource Stewardship.
- Improve Flood Management.]

Flood Risk Characterization

Flooding can deliver either environmental destruction or environmental benefits. Ecosystems can be devastated by extreme floods that wash away habitat, leaving deposits of debris and contaminants. Development in floodplains has reduced the beneficial connections between different types of habitat and adjacent floodway corridors; however, well functioning floodplains deliver a variety of benefits. Floodplains provide habitat for a significant variety of plant and wildlife species. Small, frequent flooding can recharge groundwater basins and improve water quality by filtering impurities and nutrients, processing organic wastes, and controlling erosion.

Flood management challenges in the Tulare Lake hydrologic region include:

- Maintenance of channels restricted and difficult because of permitting and environmental regulations
- Inconsistent and unreliable funding sources, especially for operations and maintenance
- Lack of storage for flood events
- Undersized and deteriorating flood infrastructure (seismic retrofits of dams)
- Need more accurate weather forecasts

The identified issues were based upon interviews with 14 agencies with varying levels of flood management responsibilities in each county of the hydrologic region. For a list of agencies with flood management responsibility in the Tulare Lake Hydrologic Region that participated in these meetings, refer California's Flood Future Report Attachment E: Information Gathering Technical Memorandum. The agencies were asked about the status of flood management in their respective areas of responsibility

Future Vision

Regional Future Vision

[This subsection would describe the desired future condition that the local stakeholders have for this region. Concepts such as regional water self-sufficiency, flood protection from a 100-year flood, conservation goals, and land use goals could be described here.]

Tribal Objectives/Vision

[Objectives and vision of the tribal interests in the region would be described here.]

Relevant Statewide Interests and Objectives

[Describe statewide interests and objectives and how they might influence or affect the region. State government initiatives would be discussed in relation to the region.]

Regional Water Planning and Management

[This subsection contains a discussion of the following topics.

- Discussion of (1) status of IRWM or other regional plans, highlighting key challenges and accomplishments; and (2) regional response strategies for meeting future water demands and quality standards, adapting to climate change, and achieving sustainability.]

[Information sources may be IRWM plans, urban water management plans, agricultural water management plans, groundwater management plans, water elements of general plans, floodplain management plans, stormwater plans, RWQCB basin plans and water quality reports, watershed management plans, habitat conservation plans, multi-species conservation plans, etc.]

[Considerations for this subsection:

- Review IRWM and other regional plan coverage, quality, level of integration, and next steps toward implementation.
- Identify needed improvements in IRWM plan coverage, participation, and integration across resource areas, institutions, watersheds, and methods.
- Showcase successful regional projects from IRWM plans.
- Summarize FloodSAFE's regional flood management plans and describe challenges and recommendations.
- Summarize RWQCB regional water quality plans and describe challenges and recommendations.
- Describe intraregional planning and management, challenges, and benefits.
- Review drought preparedness based on region and local plans.]

Integrated Regional Water Management Coordination and Planning

Flood management in the future will require unprecedented integration among traditionally varying agencies that have overlapping and sometimes conflicting goals and objectives. More reliable funding and improved agency alignment are required at all levels. Updated technical and risk management approaches will be needed to protect the public from flooding by assessing risk, as well as by improving flood readiness, making prudent land use decisions, and promoting flood awareness. Project implementation methods could benefit from IWM-based approaches to leverage the limited funding and other flood management resources. In short, future solutions should be aligned with broader watershed-wide goals and objectives and must be crafted in the context of IWM

Integrated Regional Water Management (IRWM) promotes the coordinated development and management of water, land, and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Flood management is a key component of an integrated water management strategy.

[Placeholder groundwater text. Contains:

- Provide summary of the GWMPs for the Hydrologic Region with brief description of overlap, management gaps, and degree of coordination]

Accomplishments

Local groups have begun efforts to address salt management. The City of Fresno has initiated an outreach program to inform residents on ways to reduce salt loads to water that passes through the Regional Wastewater Reclamation Facility and ultimately to their underground water supply. Also, the Red Rock Ranch, located at Five Points in Fresno County, has initiated an integrated on-farm drainage management system which includes low-pressure pivot sprinklers and minimum tillage.

During this time period, the Central Valley Water Board approved the Groundwater Quality Protection Strategy and Workplan to establish a long-term strategy that will identify high priority activities (CVRWQCB. 2010b). The Irrigated Lands Program has transitioned from an interim program that imposes requirements on discharges from irrigated lands to surface waters of the State to the long-term program that addresses discharges to both surface and ground waters of the State. The Central Valley Water Board has successfully implemented its general order for existing milk cow dairies and xx out of the xx dairies in the Tulare Lake Hydrologic Region are implementing waste and nutrient management plans. In addition, the Central Valley Water Board has successfully made improvements to its land discharge program to increase groundwater monitoring and reduce the backlog of waste discharge requirements.

In October 2011, the Glennville Mutual Water Company community water supply system began making its first deliveries of water to consumers. Approximately 30 households were connected to the new water supply system, which replaced individual private wells that had been impacted by gasoline releases in the 1980s (gasoline) and 1990s (gasoline/MTBE) at the former Glennville Shopping Center. Funding to install the \$2 million community water supply system was a multi-agency joint effort by the Central Valley Water Board (a litigation settlement fund), the State Water Board (Emergency, Abandoned and Recalcitrant Fund), and the California Department of Public Health (grant funds). Discovery of the MTBE contamination was not made until after the Central Valley Water Board settlement was finalized, thus making the Central Valley Water Board responsible for providing the residents with suitable drinking water. Central Valley Water Board staff has been coordinating the delivery of trucked and bottled water to affected residents since the late 1990s. Completion of this system is the culmination of more than a decade of staff's efforts at attaining a permanent water supply for the affected residents of Glennville.

In the Tulare Lake region, a number of flood risk management actions were accomplished which were recommended in the 2009 California Water Plan including the following:

- DWR has created a climate change handbook to help local agencies incorporate climate change into planning activities. In addition, the State of California has developed a statewide climate change adaptation strategy, requested that the National Academy of Science establish an expert panel to report on impacts of sea level rise, and issued interim guidance to agencies on planning for sea level rise in designated coastal and floodplain areas.
- DWR has collaborated with the USACE to produce California's *Flood Future: Recommendations for Managing the State's Flood Risk*, which will help guide local, State, and Federal decisions about policies and financial investments related to improved public safety and flood management throughout California. Information for the California's Flood Future Report was provided by 142 public agencies located in all 58 counties, as well as by State and Federal agencies.

- IRWM planning guidelines were revised to incorporate flood management into the process giving credit for including these flood benefits in Integrated Water Management projects.
- Comments and recommendations from the Flood Risk Management Strategy in the 2009 California Water Plan were used to inform:
- SFMP California's Flood Future Report
- IRWM planning
- Water Code Section 8307 links flood liability with local planning decisions. Cities and counties now share flood litigation liability with the State over unreasonably approved new development on previously undeveloped areas.

Challenges

A major challenge will be the development of the CV-SALTS basin plan amendments within the timeframe set by the State Recycled Water Policy. Without action to improve salts management for the Central Valley, the economic vitality of the region is threatened. A 2009 University of California study (Howitt, et al. 2009) found that salts and nitrates are already costing Central Valley residents \$544 million annually for treatment and lost production. Increasingly, freshwater supplies will be used to dilute salts, reducing supplies for people and the environment, especially during droughts. (CV-SALTS. 2012a)

The dairy industry in the Central Valley has been affected by economic factors such as the variability in milk and feed prices. The cost of complying with the General Order for Existing Milk Cow Dairies can be an disproportionate burden on smaller, less economically competitive dairies. In response, the Central Valley Water Board amended the General Order in April 2009 to allow an additional year for dairies to submit certain elements of the Waste Management Plan. The Central Valley Water Board also approved the Central Valley Dairy Representative Monitoring Program as an alternative to installing individual groundwater monitoring systems at each dairy facility. (CVRWQCB. 2011b)

As the irrigated lands program transitions to addressing groundwater quality, the most significant issues that will be addressed will include establishing the groundwater quality monitoring networks necessary to identify problem areas, assess trends, and evaluate effectiveness of practices. (CVRWQCB. 2011b)

A major challenge is the ability of small communities to address water quality issues. Small communities with wastewater treatment plants face increasingly stringent wastewater requirements and have difficulty meeting these requirements due to the cost of compliance. The Central Valley has approximately 600,000 individual onsite disposal systems within its boundaries which collectively discharge approximately 120 million gallons per day to the subsurface. Water quality impacts can occur if these systems are not properly sited or properly maintained. It can be difficult for owners of these systems to fund repairs if these systems fail.

Typically, flood management agencies in large urban areas tend to be highly organized. Agencies in more rural counties or with low exposure to flooding are often handled by emergency responders or a single contact at the county. This can present a unique set of challenges when developing a project.

Flood management in the Tulare Lake Hydrologic Region of California has a unique set of challenges that were identified during meetings with local agencies in the hydrologic region. These challenges include:

- Levee recertification
- Maintenance of channels restricted and difficult because of permitting and environmental regulations
- Inconsistent agency roles in some parts of the region
- Inconsistent and unreliable funding sources, especially for operations and maintenance
- inadequate data and flood information, including aerial images and mapping
- Federal flood insurance programs that allow too much construction in floodplains
- Cost of collecting adequate data to design flood control structures is financially infeasible
- Environmental regulations that make projects difficult to implement
- Lack of storage for flood events
- Undersized and deteriorating flood infrastructure (seismic retrofit of dams)
- Need for clarity on who is responsible for upstream/downstream impacts
- Need more accurate weather forecasts

Climate change will have a significant impact on the timing and magnitude of precipitation and runoff. Increased air temperatures could reduce the extent of snow pack in mountainous areas, thereby adding to the portion of watersheds that are available to contribute to direct winter runoff. Decreased snow pack would also reduce spring runoff volumes. Although future precipitation is somewhat uncertain, greater flood magnitudes are anticipated due to more frequent atmospheric river storm events (Dettinger, 2011). These changes could alter the magnitude and frequency of flood events, although specific effects might be difficult to reliably predict. However, the potential for increased frequency and magnitude of floods and a rise in sea level suggest that the enhancement of both structural and nonstructural measures for flood management is needed

Drought and Flood Planning

[Highlight discussion of the areas of water planning and management related to the extremes, drought and flood.]

Resource Management Strategies

[Note: (1) Align with resource management strategy impacts and benefits of IRWM standards. (2) Information for this section will be regionally derived. The “statewide” strategies (i.e., the updated text from Volume 2 of Update 2009) will be published in a separate volume, not in these regional reports.]

Strategy Availability

[This subsection contains a discussion of the following topics.]

- Subset of 27 strategies that are potentially applicable within each region.
- Estimate of benefits that could be achieved considering all constraints (e.g., institutional regulatory, finance, local opposition, technology, conveyance, local land use, etc.).]

[Considerations for this subsection:]

- Estimation of resource management strategy potential of the 27 strategies detailed in Volume 2 of Update 2009.

- Water Evaluation and Planning (WEAP) results for the Sacramento, San Joaquin, and Tulare Lake Hydrologic Regions.]

Regional Strategies

[This subsection contains a discussion of the following topics.

- Regional response packages for managing future water supply, managing flood risk, managing water quality, adapting to climate change, and achieving sustainability.]

[Considerations for this subsection:

- Highlight response strategies important to the region.
- This section will inform the strategy and policy recommendations in Volume 1 of the Update 2013 as themes become evident.
- Number of accepted plans.]

[Placeholder groundwater text. Contains:

- Discussion of the various existing groundwater related management strategies as it relates to groundwater management plans and IRWM plans, as well as conjunctive management projects and groundwater recharge projects, etc.
- Table listing the existing groundwater related management strategies.]

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11 distinct regions across the state for which stations located within a region vary with one another in a similar fashion. These 11 climate regions are used when describing climate trends within the state (Abatzoglou, J.T., et al, 2009). DWR's hydrologic regions do not correspond directly to WRCC's climate regions. A particular hydrologic may overlap more than one climate region, and hence have different climate trends in different areas. For the purpose of this regional report, climate trends of overlapped climate regions are considered to be relevant trends for respective portions of the overlapping hydrologic region.

Additional References

[List references here.]

Personal Communications

[List references here.]

Table TL-1 Integrated Regional Water Management Grants Awarded

Map No.	Integrated Regional Water Management (IRWM) Region and Project	Prop. 84 Round 1 — 2011 Planning Award	Prop. 84 Round 1 — 2011 Impl. Award	Prop. 1E Round 1 — 2011 SWFM Award	Prop. 84 Round 2 — 2012 Planning Award	Prop. 84 Round 2 — 2012 Impl. Award	Prop. 84 2012 Local Groundwater Assistance Award
14	Kaweah River Basin						
	Kaweah Delta Water Conservation District		\$4,643,000				
24	Poso Creek						
	Semitropic Water Storage District-Implementation		\$8,215,000				
38	Upper Kings Basin Water Forum						
	Upper Kings Basin IRWM Authority - IRWMP Update	\$269,890					
	Upper Kings Basin IRWM Authority - Implementation		\$8,496,000				
	Fancher Creek Flood Control Improvement Project			\$2,231,086			

Table TL-2 Selected Regionally Endemic Endangered Plant Species

Common name	Scientific name	Fed. status	CA status	CA NPS rank
Caper-fruited Tropidocarpum	<i>Tropidocarpum capparideum</i>			1B.1
Diamond-petaled California Poppy	<i>Eschscholzia rhombipetala</i>			1B.1
Fort Tejon Woolly Sunflower	<i>Eriophyllum lanatum</i> var. <i>hallii</i>			1B.1
Greene's Tuctoria	<i>Tuctoria greenei</i>	FE	SR	1B.1
Hispid Bird's-beak	<i>Chloropyron molle</i> ssp. <i>hispidum</i>			1B.1
Hoover's Spurge	<i>Chamaesyce hooveri</i>	FT		1B.2
Keck's Checkerbloom	<i>Sidalcea keckii</i>	FE		1B.1
Lesser Saltscale	<i>Atriplex minuscula</i>			1B.1
Mason's Neststraw	<i>Stylocline masonii</i>			1B.1
Mojave Tarplant	<i>Deinandra mohavensis</i>		SE	1B.3
Pale-yellow Layia	<i>Layia heterotricha</i>			1B.1
Palmate-bracted Bird's-beak	<i>Chloropyron palmatum</i>	FE	SE	1B.1
Piute Mountains Navarretia	<i>Navarretia setiloba</i>			1B.1
Prostrate Vernal Pool Navarretia	<i>Navarretia prostrata</i>			1B.1
San Joaquin Valley Orcutt Grass	<i>Orcuttia inaequalis</i>	FT	SE	1B.1
San Joaquin Woollythreads	<i>Monolopia congdonii</i>	FE		1B.2
Showy Golden Madia	<i>Madia radiata</i>			1B.1
Slough Thistle	<i>Cirsium crassicaule</i>			1B.1
Succulent Owl's-clover	<i>Castilleja campestris</i> ssp. <i>succulenta</i>	FT	SE	1B.2

Table TL-3 Selected California Endemic Endangered Plant Species

Common Name	Scientific Name	Fed. Status ^a	CA Status ^a	CA NPS Rank ^b
Bakersfield Cactus	<i>Opuntia basilaris</i> var. <i>treleasei</i>	FE	SE	1B.1
California Jewel-flower	<i>Caulanthus californicus</i>	FE	SE	1B.1
Comanche Point Layia	<i>Layia leucopappa</i>			1B.1
Hall's Tarplant	<i>Deinandra halliana</i>			1B.1
Kaweah Brodiaea	<i>Brodiaea insignis</i>		SE	1B.2
Kern Mallow	<i>Eremalche kernensis</i>	FE		1B.1
Kings Gold	<i>Tropidocarpum californicum</i>			1B.1
Oil Neststraw	<i>Stylocline citroleum</i>			1B.1
Ramshaw Meadows Abronia	<i>Abronia alpina</i>	FC		1B.1
Rayless Layia	<i>Layia discoidea</i>			1B.1
San Benito Evening-primrose	<i>Camissonia benitensis</i>	FT		1B.1
San Joaquin Adobe Sunburst	<i>Pseudobahia peirsonii</i>	FT	SE	1B.1
Shevock's Rockcress	<i>Boechera shevockii</i>			1B.1
Springville Clarkia	<i>Clarkia springvillensis</i>	FT	SE	1B.2
Striped Adobe-lily	<i>Fritillaria striata</i>		ST	1B.1
Tehachapi Buckwheat	<i>Eriogonum callistum</i>			1B.1
Tejon Poppy	<i>Eschscholzia lemmonii</i> ssp. <i>kernensis</i>			1B.1
Vasek's Clarkia	<i>Clarkia tembloriensis</i> ssp. <i>calientensis</i>			1B.1
Coulter's Goldfields	<i>Lasthenia glabrata</i> ssp. <i>coulteri</i>			1B.1
Horn's Milk-vetch	<i>Astragalus hornii</i> var. <i>hornii</i>			1B.1
Round-leaved Filaree	<i>California macrophylla</i>			1B.1

NOTES: Table shows only Federally Endangered and/or State Endangered and/or CA Native Plant Society Rank 1B.1 plant species.

^a State and Federal Status Legend

SE = State-listed as Endangered

ST = State-listed as Threatened

FP = Fully Protected under the CA Dept. of Fish & Game

FE = Federally-listed as Endangered

SCE = Candidate for State Listing as Endangered

FC = Candidate for Federal Listing

^b California Native Plant Society Rank

1B.1 = Plants Rare, or Seriously Threatened or Endangered in CA and elsewhere

1B.2 = Plants Rare, or Fairly Threatened or Endangered in CA and elsewhere

1B.3 = Plants Rare, or More or Less Threatened or Endangered in CA and elsewhere

Table TL-4 Endangered Wildlife Species

Common Name	Scientific Name	Fed. Status^a	CA Status^a	Type
Sierra Madre Yellow-legged Frog	<i>Rana muscosa</i>	FE	SCE	Amphibian
Sierra Nevada Yellow-legged Frog	<i>Rana sierrae</i>	FC	SCE	Amphibian
Bald Eagle	<i>Haliaeetus leucocephalus</i>	FD	SE, FP	Bird
California Condor	<i>Gymnogyps californianus</i>	FE	SE	Bird
Golden Eagle	<i>Aquila Chrysaetos</i>		FP	Bird
Great Gray Owl	<i>Strix nebulosa</i>		SE	Bird
Least Bell's Vireo	<i>Vireo bellii pusillus</i>	FE	SE	Bird
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	FE	SE	Bird
Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	FC	SE	Bird
White-tailed Kite	<i>Elanus Leucurus</i>		FP	Bird
Willow Flycatcher	<i>Empidonax traillii</i>		SE	Bird
Vernal Pool Tadpole Shrimp	<i>Lepidurus packardii</i>	FE		Invertebrate
Buena Vista Lake Shrew	<i>Sorex ornatus relictus</i>	FE		Mammal
Fresno Kangaroo Rat	<i>Dipodomys nitratooides exilis</i>	FE	SE	Mammal
Giant Kangaroo Rat	<i>Dipodomys ingens</i>	FE	SE	Mammal
San Joaquin Kit Fox	<i>Vulpes macrotis mutica</i>	FE	ST	Mammal
Sierra Nevada Bighorn Sheep	<i>Ovis canadensis sierrae</i>	FE	SE, FP	Mammal
Tipton Kangaroo Rat	<i>Dipodomys nitratooides nitratooides</i>	FE	SE	Mammal
Blunt-nosed Leopard Lizard	<i>Gambelia sila</i>	FE	SE, FP	Reptile

NOTES: Table shows only Federally Endangered or State Endangered wildlife species. There are no FE or SE fish species in the TL HR.

State and Federal Status Legend

SE = State-listed as Endangered

ST = State-listed as Threatened

FP = Fully Protected under the CA Dept. of Fish & Game

FE = Federally-listed as Endangered

SCE = Candidate for State Listing as Endangered

FC = Candidate for Federal Listing

Table TL-5 Disadvantaged Communities by County with Populations of 2,000 or More

Map Number (Red Dot)	Name	Place Type ^a	Population	MHI	County
1	Caruthers	CDP	2,883	\$44,545	Fresno
2	Coalinga	City	13,086	\$46,229	Fresno
3	Easton	CDP	2,017	\$44,390	Fresno
4	Fresno ^b	City	484,008	\$43,124	Fresno
5	Huron	City	6,691	\$20,410	Fresno
6	Mayfair	CDP	4,046	\$40,288	Fresno
7	Mendota	City	10,459	\$25,216	Fresno
8	Orange Cove	City	8,718	\$26,942	Fresno
9	Parlier	City	13,928	\$34,405	Fresno
10	Reedley	City	23,669	\$46,693	Fresno
11	Riverdale	CDP	3,193	\$48,333	Fresno
12	San Joaquin	City	3,927	\$26,731	Fresno
13	Sanger	City	23,370	\$42,444	Fresno
14	Selma	City	22,617	\$44,778	Fresno
15	Arvin	City	18,329	\$32,949	Kern
16	Delano	City	51,310	\$35,673	Kern
17	Ford City	CDP	3,684	\$26,053	Kern
18	Greenfield	CDP	3,996	\$45,851	Kern
19	Lake Isabella	CDP	3,287	\$19,627	Kern
20	Lamont	CDP	15,365	\$33,799	Kern
21	Lost Hills	CDP	2,143	\$29,632	Kern
22	McFarland	City	12,302	\$35,656	Kern
23	Oildale	CDP	32,754	\$35,538	Kern
24	Shafter	City	16,378	\$35,915	Kern
25	South Taft	CDP	2,177	\$36,250	Kern
26	Taft	City	9,370	\$46,324	Kern
27	Tehachapi	City	14,080	\$46,067	Kern
28	Wasco	City	25,143	\$40,054	Kern
29	Weedpatch	CDP	2,429	\$24,324	Kern
30	Weldon	CDP	2,304	\$32,690	Kern
31	Wofford Heights	CDP	2,497	\$25,224	Kern
32	Armona	CDP	3,046	\$43,609	Kings
33	Avenal	City	15,749	\$33,350	Kings
34	Corcoran	City	25,136	\$35,051	Kings
35	Lemoore Station	CDP	7,890	\$42,151	Kings
36	Cutler	CDP	5,058	\$30,062	Tulare
37	Dinuba	City	20,823	\$39,165	Tulare
38	Earlimart	CDP	6,596	\$25,236	Tulare
39	East Porterville	CDP	6,498	\$27,765	Tulare
40	Exeter	City	10,139	\$43,690	Tulare
41	Farmersville	City	10,283	\$32,886	Tulare

Map Number (Red Dot)	Name	Place Type ^a	Population	MHI	County
42	Goshen	CDP	3,214	\$34,653	Tulare
43	Ivanhoe	CDP	4,315	\$35,603	Tulare
44	Lindsay	City	11,528	\$30,085	Tulare
45	Orosi	CDP	8,745	\$34,846	Tulare
46	Pixley	CDP	2,949	\$35,759	Tulare
47	Poplar-Cotton Center	CDP	2,095	\$33,556	Tulare
48	Porterville	City	52,762	\$39,838	Tulare
49	Richgrove	CDP	2,694	\$28,261	Tulare
50	Strathmore	CDP	3,298	\$19,983	Tulare
51	Terra Bella	CDP	3,551	\$26,585	Tulare
52	Tipton	CDP	2,172	\$37,171	Tulare
53	Tulare	City	56,938	\$46,647	Tulare
54	Woodlake	City	7,178	\$29,417	Tulare

Notes:

^a CDP = Census Designated Place.

^b Excludes Fort Washington, Old Fig Garden, and Sunnyside CDPs.

Table TL-6 Tulare Lake Hydrologic Region Population by County

County	July 2000	July 2005	April 2010
Fresno	784,514	854,116	912,334
Kern	593,130	686,039	759,693
Kings	129,764	144,601	152,982
Los Angeles	8	3	2
San Benito	77	74	72
San Luis Obispo	43	41	38
Tulare	368,805	408,403	442,179
Ventura	10	29	35
HR TOTAL	1,876,351	2,093,306	2,267,335

Note: County populations are for areas in the Tulare Lake HR only.

Table TL-7 Tulare Lake Hydrologic Region 2010 Top Ten Populous Incorporated Cities

City	County	2010 Population
Fresno	Fresno	484,008
Bakersfield	Kern	331,868
Visalia	Tulare	119,312
Clovis	Fresno	91,166
Tulare	Tulare	56,938
Porterville	Tulare	52,762
Hanford	Kings	52,315
Delano	Kern	51,310
Wasco	Kern	25,143
Corcoran	Kings	25,136

Table TL-8 Tulare Lake Hydrologic Region 20 Crop Type Acreages 2005-2009

Crop Type	2005	2006	2007	2008	2009
Grain	181,700	200,000	168,700	238,900	205,500
Rice	0	0	0	0	0
Cotton	542,800	430,100	340,300	190,000	142,800
Sugar Beets	13,100	11,500	7,100	5,100	400
Corn	326,400	335,100	358,600	397,500	383,200
Dry Beans	13,700	17,300	13,900	8,600	19,800
Safflower	5,100	5,600	12,400	54,500	9,200
Other Field Crops	228,000	233,600	221,200	268,400	291,700
Alfalfa	353,900	336,900	313,800	338,900	352,900
Pasture	21,100	17,400	13,400	30,200	45,600
Processing Tomatoes	119,500	119,400	135,600	128,900	133,100
Market Tomatoes	9,900	7,400	2,900	6,600	7,200
Cucurbits	33,500	25,900	28,100	26,000	24,300
Onions and Garlic	38,100	42,700	41,700	40,900	42,000
Potatoes	23,500	26,900	16,000	15,500	14,000
Other Truck Crops	124,700	128,600	120,400	104,200	92,400
Almonds/Pistachio	325,700	417,900	443,300	467,200	475,900
Other Deciduous Trees	210,500	204,800	218,300	217,900	210,900
Subtropical	219,300	226,900	231,300	221,600	210,900
Vineyard	339,600	353,100	354,300	361,000	348,500
SUBTOTAL	3,130,100	3,141,100	3,041,300	3,121,900	3,010,300
DOUBLE CROP	173,500	186,700	170,500	209,600	157,700
TOTAL LAND ACRES	2,956,600	2,954,400	2,870,800	2,912,300	2,852,600

Notes:

Based on DWR Land and Water Use Standard 20 Crop Types

Other Field Crops: Flax, hops, grain sorghum, sudan, castor beans, miscellaneous fields, sunflowers, hybrid sorghum/sudan, millet and sugar cane

Cucurbits: Melons, squash and cucumbers

Other Truck Crops: Artichokes, asparagus, beans (green), carrots, celery, lettuce, peas, spinach, flowers nursery and tree farms, bush berries, strawberries, peppers, broccoli, cabbage, cauliflower and brussel sprouts

Other Deciduous Trees: Apples, apricots, cherries, peaches, nectarines, pears, plums, prunes, figs, walnuts and miscellaneous deciduous

Table TL-9 Federally Recognized Tribes in Tulare Lake Hydrologic Region

Name of Tribe	Acres	Cultural Affiliation
Cold Springs Reservation	155	Western Mono Indians
Santa Rosa Rancheria	1,803	Tache, Tachi, and Yokuts Indians
Tule River Reservation	55,395	Yokuts Indians

**Table TL-10 Integrated Regional Water Management
Tribal Participation in Tulare Lake Hydrologic Region**

Map Number (Square)	IRWM	Participating Tribes
14	Kaweah River Basin	
15	Kern County	Tubatulabal Tribe of Kern Valley
24	Poso Creek	
33	Southern Sierra	Tule River Indian Tribe
35	Tule	
38	Upper Kings Basin Water Forum	
44	Westside - San Joaquin	

Note: Map Number refers to Figure TL-2 IRWMs and DACs.

Table TL-11 Surface Water Deliveries to Kern National Wildlife Refuge (Thousand Acre-Feet)

Source	2005	2006	2007	2008	2009
CVPIA	19.9	21.8	21.6	17.7	19.6

Table TL-12 Surface Water Deliveries to Mendota Wildlife Area (Thousand Acre-Feet)

Source	2005	2006	2007	2008	2009
CVPIA	25.5	21.8	29.8	26.4	25.5

**Table TL-14 Selected Organizations in
Tulare Lake Hydrologic Region Involved in Water Governance**

Entity	Task
Federal	
Friant-Kern Canal (CVP)	Interregional water supply
US Bureau of Reclamation	Operation of Friant Dam
US Corps of Engineers	Operation of Pine Flat, Isabella, & Kaweah dams
State	
Kern County Water Agency	Water supply and flood control
State Water Project	Interregional water supply
Local	
Alpaugh Joint Powers Authority	Alpaugh ID and Tulare Co. Water Works District
Bear Valley Springs Community Services District	Water, police, roads, wastewater, solid waste
City of Fresno, Water Division	Water
Deer Creek and Tule River Authority	Water conservation, groundwater management
Dudley Ridge Water District	SWP contractor
Fresno Metro Flood Control District	Local flood control
Friant Water Authority	Friant-Kern Canal maintenance
Henry Miller Recreation District 2131	Evacuate runoff and maintain internal drainage
Kaweah Delta Water Cons District	Management of Kaweah River water
Kings River Conservation District	Flood protection, water supply, power
Kings River Water Association	Kings River entitlements, deliveries, water quality
Panoche Drainage District	Maintain internal drainage
Pinedale County Water District	Water, wastewater, solid waste
So. San Joaquin Municipal Utility District	Agricultural water from CVP, WAPA Power
Tulare Lake Basin Water Storage District	Delivery, storage of SWP water
Tulare Lake Drainage District	Drainage Management

Table TL-15 Tulare Lake Hydrologic Region Water Demands

AW Demand Type	2005	2006	2007	2008	2009
Total Ag AW as % of Total AW	92.7%	93.3%	92.5%	92.8%	93.5%
Total Wildlife Refuge AW as % of Total AW	0.7%	0.6%	0.7%	0.7%	0.6%
Total M & I AW as % of Total AW	6.6%	6.0%	6.9%	6.5%	5.9%

Table TL-16 Community Water Systems by Size and Population Served

Water System Size	No. of Community Systems	Percent of Community Systems in Region	Population Served	Percent of Population Served
Large (> 10,000 Pop)	35	10%	2,036,266	88%
Medium (3301 - 10,000 Pop)	22	6%	153,154	7%
Small (500 - 3300 Pop)	63	18%	81,840	4%
Very Small (< 500 Pop)	234	66%	31,477	1%
CWS that Primarily Provide Wholesale Water	1	0%	---	---
Total	355		2,302,737	

Note: FCWWD #37/MILE HIGH (System No. 1000040) service area is in both the Tulare Lake Basin & San Joaquin River Regions. To avoid duplication it is only included in the Tulare Lake Hydrologic Region.

Table TL-17 Summary of Community Drinking Water Systems in the Tulare Lake Hydrologic Region That Rely on One or More Contaminated Groundwater Well That Exceeds a Primary Drinking Water Standard

Community Drinking Water Systems and Groundwater Wells Grouped by Water System Population	No. of Affected Community Drinking Water Systems	No. of Affected Community Drinking Water Wells
Small System $\leq 3,300$	110	163
Medium System 3,301 - 10,000	12	29
Large System $\geq 10,000$	24	137
Total	146	329

Source: Water Boards 2012 Draft Report on "Communities that Rely on Contaminated Groundwater"

Table TL-18 Summary of Contaminants Affecting Community Drinking Water Systems in the Tulare Lake Basin Hydrologic Region

Principal Contaminant (PC)	Community Drinking Water Systems where PC exceeds the Primary MCL	No. of Community Drinking Water Wells where PC exceeds the Primary MCL
Arsenic	62	131
Nitrate	54	75
Gross alpha particle activity	46	78
Uranium	21	29
1,2-Dibromo-3-chloropropane (DBCP)	17	61

Source: Water Boards 2012 Draft Report on "Communities that Rely on Contaminated Groundwater"

Notes:

Only the 5 most prevalent contaminants are shown.

Wells with multiple contaminants

13 wells are affected by Arsenic and Gross alpha particle activity

11 wells are affected by Nitrate and 1,2-Dibromo-3-chloropropane (DBCP)

10 wells are affected by Nitrate and Gross alpha particle activity

**Table TL-19 Tulare Lake Hydrologic Region Exposures
within the 100-Year and 500-Year Floodplains**

Segment Exposed	1% (100-year) Floodplain	0.2% (500-year) Floodplain
Population	134,100, 7%	498,200, 27%
Structure and Content Value	\$8.3 billion	\$32.0 billion
Crop Value	\$1.8 billion	\$2.3 billion
Crops (acres)	801,000	990,000
Tribal Lands (acres)	109	109
Essential Facilities (count)	71	254
High Potential-Loss Facilities (count)	50	71
Lifeline Utilities (count)	11	25
Transportation Facilities (count)	538	744
Department of Defense Facilities (count)	7	7
State and Federal Threatened, Endangered, Listed ,and Rare Plants ^a	94	94
State and Federal Threatened, Endangered, Listed ,and Rare Animals ^a	101	103

Source: SFMP California's Flood Future Report.

Note:

^a Many Sensitive Species have multiple occurrences throughout the state and some have very large geographic footprints that may overlap more than one analysis region. As a result, a single Sensitive Species could be counted in more than one analysis region. Because of this the reported statewide totals will be less than the sum of the individual analyses regions.

Table TL-20 List of 2010 Urban Water Management Plan Updates by Urban Water Supplier

Urban Water Suppliers
Bear Valley Community Services District
California Water Service Company Bakersfield
California Water Service Company Kern River Valley
California Water Service Company Selma
California Water Service Company Visalia
Clovis, City of
Delano City of
East Niles Community Service District
Exeter, City of
Fresno, City of
Golden Hills Community Services District
Hanford, City of
Kern County Water Agency Improvement District No 4
North of The River Municipal Water District
Oildale Mutual Water Company
Shafter, City of
Stallion Springs Community Services District
Tehachapi, City of
Tehachapi-Cummings County Water District
Tulare, City of
Vaughn Water Company
Wasco City of
Wasco City of
West Kern Water District
West Kern Water District

Figure TL-2 Tulare Lake Hydrologic Region Disadvantaged Communities and Integrated Regional Water Management

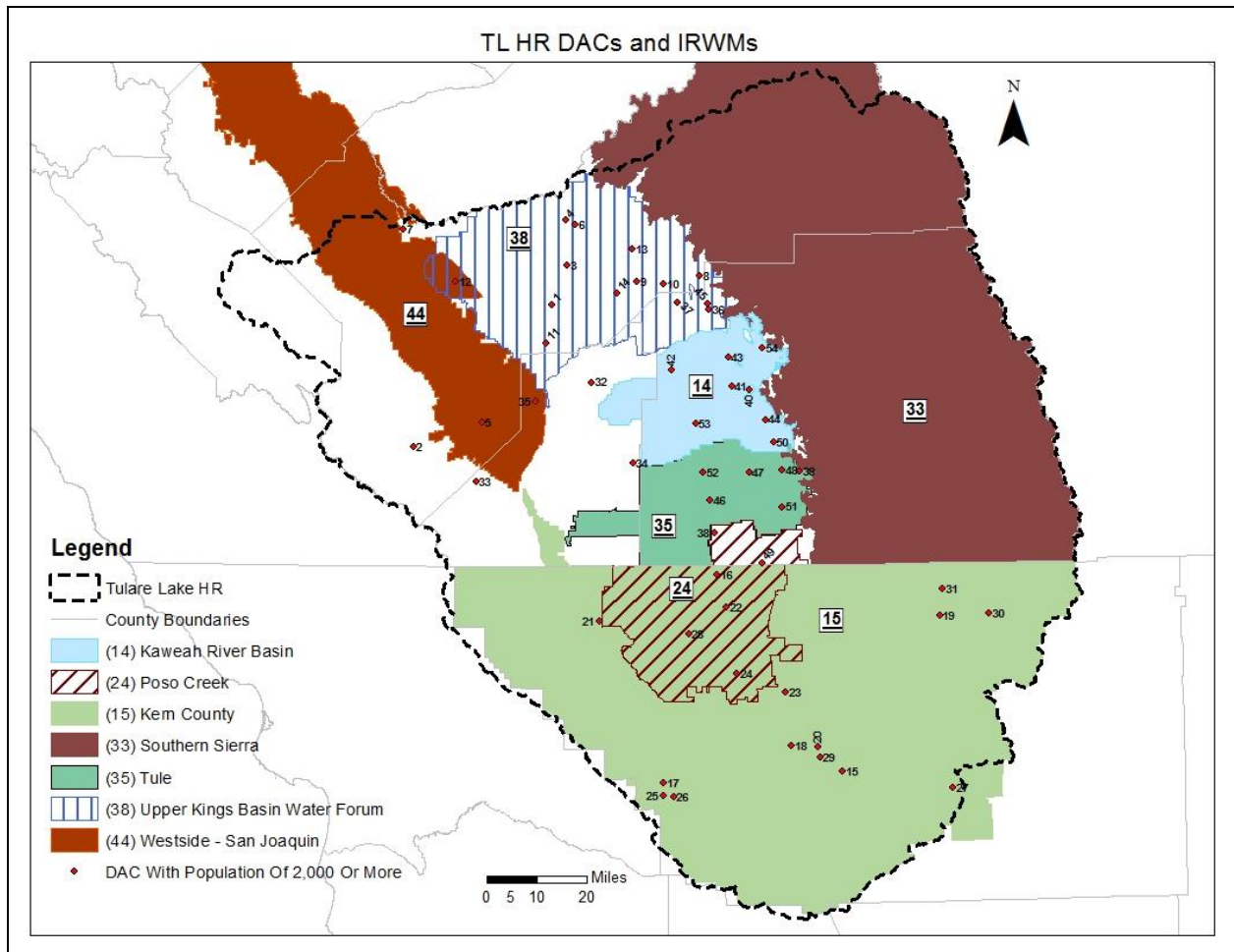


Figure TL-3 Total Agricultural Applied Water By Supply Source (Thousand Acre-Feet)
(with Supply Source as Percentage of Total Agricultural Applied Water)

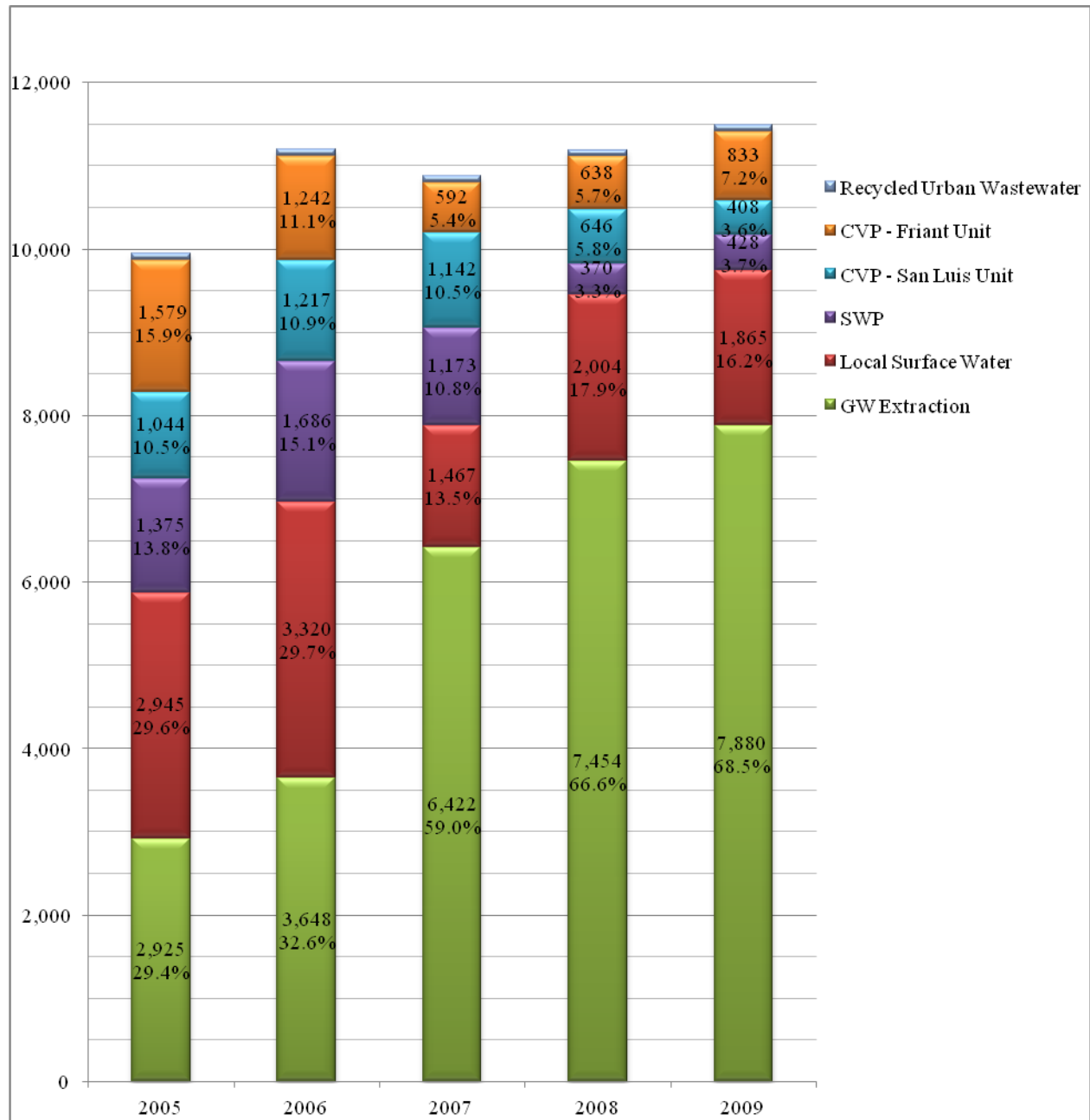







Figure TL-4 Relative Energy Intensity of Water Supply Sources

type of water	energy intensity ( white bulb = 0;  yellow bulb = 1-500 Kwh./AF)
Colorado (Project)	<i>None in this region</i>
Federal (Project)	
State (Project)	
Local (Project)	
Local Imports	<i>None in this region</i>
Groundwater	